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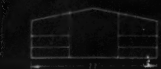
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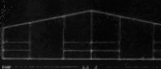
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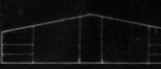
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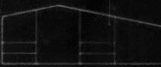
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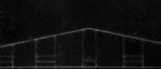
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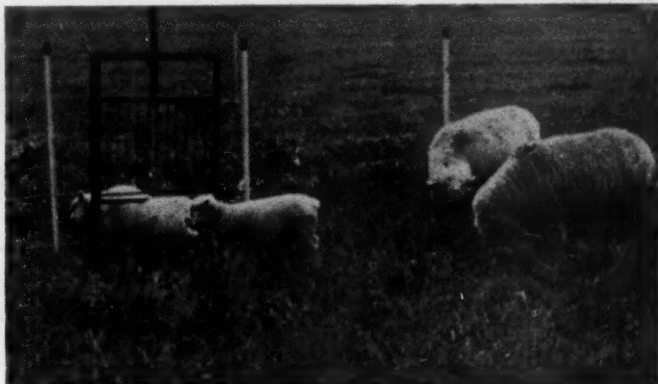
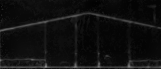
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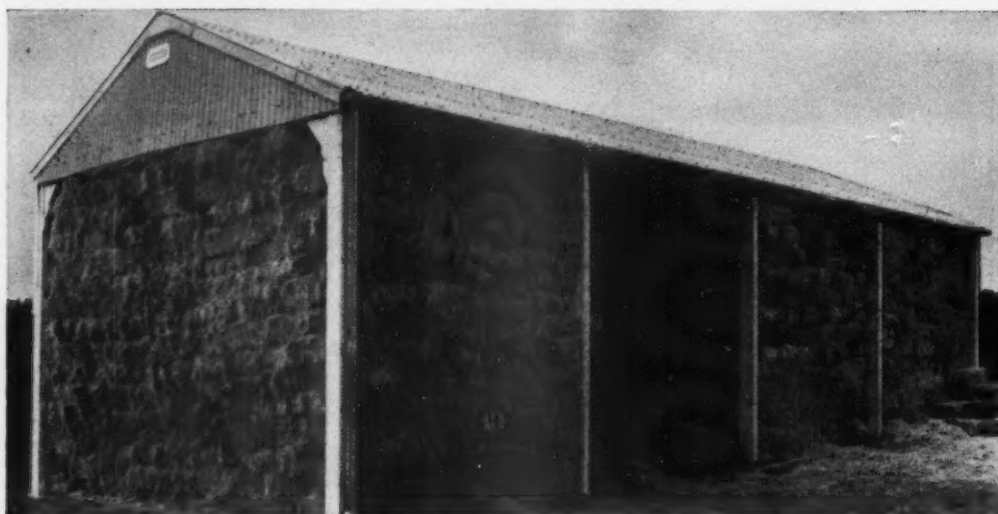
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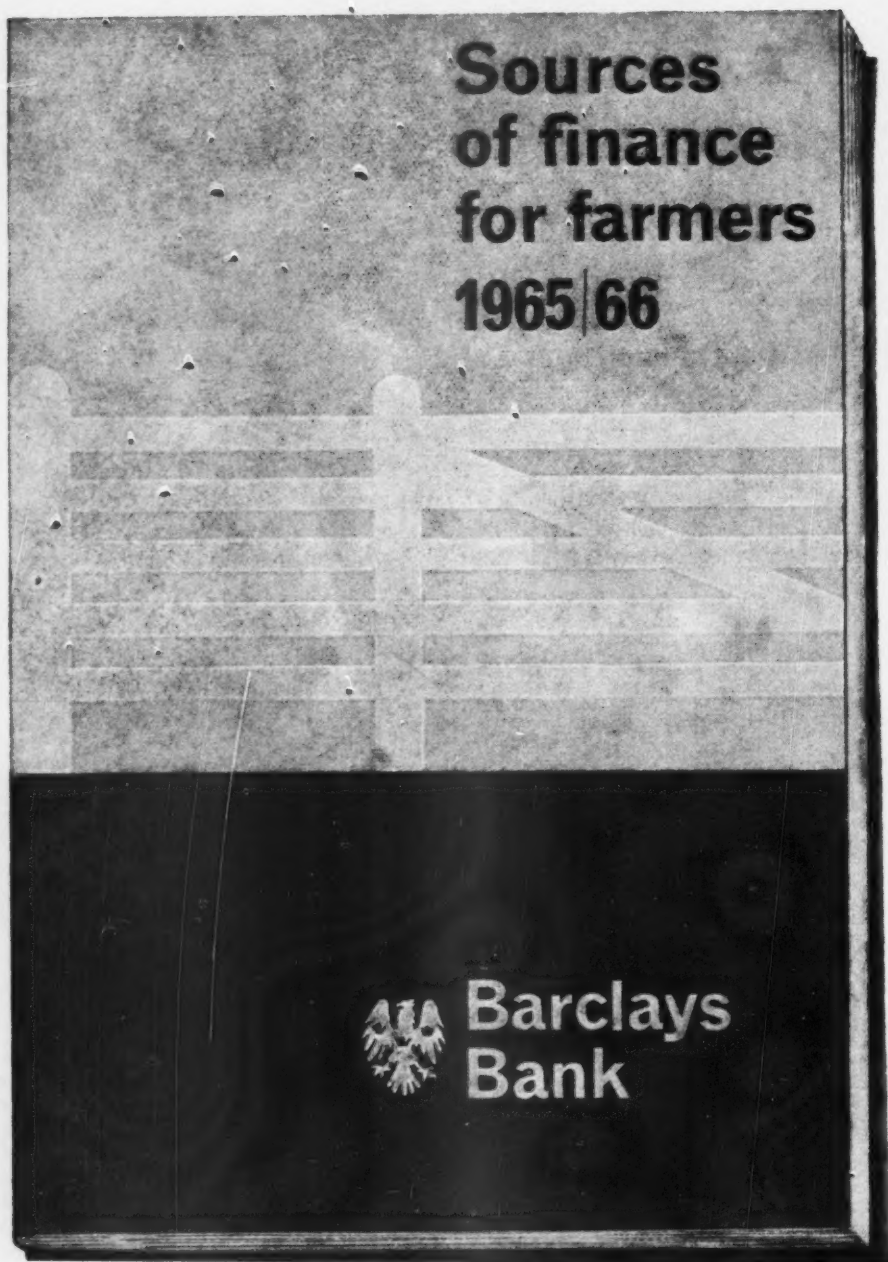
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Overturning Tractors

IN 1961, 141 people were accidentally killed on the farms of England and Wales; last year the total was 93. Non-fatal accidents in 1965 were 1,300 fewer than in the previous year. These figures show that recent measures to promote farm safety are having some effect. However, the main cause of fatal accidents remains the overturning tractor. In 1965 nearly 40 per cent of the fatal accidents on farms were caused by tractors overturning, and during the last nine years 300 tractor drivers have been killed in this way.

Publicity has been used to educate and warn drivers but without much effect. Anti-overturning devices have also been tried but none has proved to be wholly effective in all circumstances. It does not seem possible to prevent tractors sometimes overturning and the practical alternative therefore is to provide anti-crush protection for the driver. Sweden made safety cabs compulsory in 1959, and, although tractors continued to overturn, only one person has since lost his life there. In England one firm of agricultural contractors who fitted safety cabs to their tractors have had a number of overturning incidents in which the drivers emerged unscathed.

Should we accept an annual death roll of between 30 and 40 tractor drivers as inevitable? It has recently been decided that something ought to be done, and it is now proposed that regulations should be made which, in due time, will require that an approved safety cab or frame is fitted on all tractors. We can therefore look forward to a time when a life will not be lost if a tractor overturns.

G. S. WILSON

Rabbits and Myxomatosis

A. R. Mead-Briggs

THE Ministry's Infestation Control Laboratory is often asked what the present position is with regard to rabbit numbers and to myxomatosis. It is surprisingly difficult to provide simple, yet fully satisfying, answers to these questions. Why should this be so? One reason is that even casual observation indicates a marked local and temporal variability in the situation. In most counties one can point to places where the rabbit has scarcely reappeared since the first wholesale slaughter by myxomatosis, whereas there are other areas in which rabbits are again a constant problem, often despite repeated outbreaks of myxomatosis. Sometimes myxomatosis causes a high mortality, sometimes not. There have been many changes in agricultural practice during the last decade and some of these, such as the grubbing up of hedges, have made the immediate environment less suitable as rabbit habitat. There are also marked variations in the extent to which organized, yet conventional, rabbit control is efficiently practised. The following paragraphs attempt to explain some of the anomalies presented by myxomatosis and to review some recent and current research.*

Spread and establishment of myxomatosis

The virus that causes myxomatosis reached Britain in the late summer of 1953 and was first confirmed among wild rabbits at Bough Beech, near Edenbridge, Kent, during October, 1953. By the end of the year myxomatosis had been reported from eight localities in four south-eastern counties. Although there was little expansion in the areas of the initial outbreaks during the early months of 1954, the disease had maintained itself over the winter.

Numerous outbreaks were reported from the southern counties of Britain in the summer of 1954 and many were probably initiated deliberately by the movement of infected rabbits, although this practice was made illegal by the Pests Act 1954. These isolated outbreaks gradually spread until they merged; by the end of 1954 much, but not all, of southern Britain had been affected and there were active outbreaks of the disease in every county in England and Wales. During 1955 the disease continued its spread, and by the autumn most areas that had been infested by any quantity of rabbits had seen the ravages of myxomatosis. The disease was markedly less widespread by the end of 1955. Although myxomatosis became much scarcer, it did not die out. Table 1 shows the number of administrative counties in England and Wales reporting active outbreaks of myxomatosis at the end of each year. (Huntingdonshire and Soke of Peterborough treated as one county.) It will

*Previous articles about myxomatosis have appeared in the February, 1954, October, 1954, and May, 1956, issues of *Agriculture*.

Wild European rabbit infected with myxoma virus, showing typically swollen eyelids and swellings at base of ears



be seen that outbreaks were observed in about a quarter of the counties in England and Wales in December 1955 and 1956 and increased thereafter. By 1961 myxomatosis was firmly established as a disease permanently circulating in rabbit populations within each county.

TABLE I

December	Number of counties with myxomatosis	Number of counties without known myxomatosis	
		England	Wales
1953	4	43	13
1954	60	0	0
1955	17	31	12
1956	14	35	11
1957	34	14	12
1958	38	9	13
1959	42	10	8
1960	52	4	4
1961	58	1	1
1962	49	4	7
1963	57	1	2
1964	58	0	2
1965	(Not available)		

Transmission of myxomatosis

Observations made in Kent during 1954 by Armour and Thompson¹ indicated that the disease spread slowly, the average advance being only 3.5 miles per month. This was inconsistent with experience in Australia and in France, where the rate of spread was very much greater. In Australia the disease is usually transmitted by mosquitoes feeding first on an infected rabbit and then on a healthy one. The myxoma virus particles are picked up on the insect's mouth-parts whilst these probe through the skin lesions caused by the disease. The infective virus can be wiped off the mouth-parts into the

skin of the next rabbit on which the insect feeds. Studies done in 1954-55 by Muirhead-Thomson² indicated that various species of woodland mosquitoes were not important vectors of myxomatosis in south-east England, and he indirectly confirmed an unpublished suggestion by Miriam Rothschild that the rabbit flea (*Spilopsyllus cuniculi* (Dale)) would be the most important vector in Britain.

Transmission by relatively immobile vectors such as fleas accounts well for the observed slow spread of myxomatosis in Britain. Unlike mosquitoes, which are markedly seasonal in their activity, rabbit fleas are found on rabbits throughout the year and thus outbreaks of myxomatosis can occur and be maintained almost regardless of season.

Changes in virulence

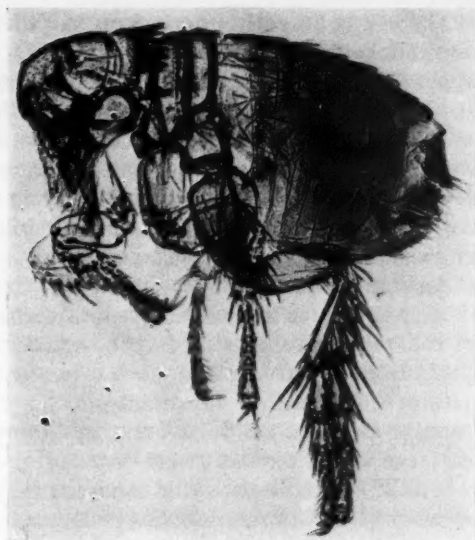
The strain of myxoma virus which reached Britain in 1953 was highly virulent. The mortality rate among wild rabbits infected during the early outbreaks of myxomatosis was nearly 100 per cent; probably fewer than five rabbits in a thousand survived infection. Most of the rabbits left after the initial spread had not recovered from the disease, but had fortuitously escaped being infected.

It is a simple maxim that a virus (or other pathogen) producing a disease that is rapidly fatal and that is readily spread to most individuals in the population runs a risk of dying out for lack of fresh hosts to infect. Obviously myxoma virus has avoided this fate. A clear understanding of how this has happened is essential to an appreciation of the influence that myxomatosis will have on rabbit numbers in the future.

Viruses, like other living material, are liable to undergo occasional changes by mutation and to multiply true in their new forms. Mutations have occurred with myxoma and some of the new strains have caused a more protracted, less severe, disease from which some rabbits recover. The first British example of a weakened, or attenuated, strain of myxoma virus that caused an extensive outbreak among wild rabbits was in Sherwood Forest during 1955. From time to time other attenuated strains were recovered from natural outbreaks, but there was little detailed knowledge of the relative virulence and abundance of the different attenuated strains which occurred, or of their geographical distribution, until the completion of a recent national survey by Fenner and Chapple.³

During October and November, 1962, field staff in 85 counties throughout England, Scotland and Wales collected 222 myxoma-infected rabbits and sent the carcasses to the laboratory at Worplesdon. A purified sample of virus was obtained from each carcass and groups of six laboratory rabbits were injected with small, standardized doses of this preparation. The course of the disease in each rabbit and the day of death, if the infection proved fatal, were recorded. Previous studies had shown that the best practical assessment of the virulence of a sample of myxoma virus is given by the mean survival time of groups of laboratory rabbits treated in this way. The results of the study are summarized in Table 2. It will be seen that the 222 samples of virus are grouped into six categories of decreasing virulence with estimates of the percentage mortality rates they cause in laboratory rabbits (or fully susceptible wild rabbits). It can be assumed that had a similar study been conducted in 1954, all samples obtained would have been placed in the category with an

*European rabbit flea
(female). The most
important vector of
myxomatosis in Britain*



expected case-mortality rate in excess of 99 per cent. It is clear that in the course of 8-9 years a single, highly virulent strain of virus has been replaced by a considerable number of strains differing widely in their virulence. There was no tendency for the strains of similar virulence to be restricted to particular regions of the country. This survey was initiated over three years ago, but it is considered unlikely that there have been substantial changes in the general pattern of attenuation of virus since then, although this will need confirmation in due course.

TABLE 2

	Greater than					Less than
Virulence (% case-mortality rate)	99	99-95	95-90	90-70	70-50	50
Number of samples	9	39	86	55	31	2
Percentage of samples	4.1	17.6	38.8	24.8	14.0	0.9

Immunity and resistance of rabbits to myxomatosis

The data in Table 2 show that most outbreaks in Britain in the autumn of 1962 (64 per cent) were caused by strains of virus expected to kill between 70 and 95 per cent of infected, highly susceptible rabbits. These may appear to be high kills, but it is the survivors we must consider. A rabbit which recovers from myxomatosis acquires active immunity to the disease; its blood will contain antibodies and it will survive subsequent infection by any strain of myxoma virus, even the most virulent. Thus, immune rabbits will not be removed from the population by recurrent myxomatosis, and most should be capable of normal breeding. When an immune doe becomes pregnant, some of her myxoma-antibodies will pass to her embryos and they will be born with some protection against the disease. Such passively, or maternally, acquired immunity is transient, and disappears within 2-3 months of birth. However, if the young rabbits are infected during this period, the disease will tend to be less severe than in young without passive immunity and those which survive will have acquired lasting, active immunity.

There was an early impression that all European rabbits, both wild and domesticated, were uniformly, and highly, susceptible to myxomatosis. This appeared entirely reasonable since all infected rabbits died, but with the appearance of attenuated strains which killed only a proportion of rabbits, it was apparent that there were differences in host resistance. If these differences were determined by genetic factors, then in the event of recurrent outbreaks of myxomatosis, normal processes of natural selection acting by the preferential removal of the less resistant forms would lead to a progressive increase in genetic, or inherited, resistance.

Australian workers have shown that the genetic resistance of many wild rabbits now alive in Australia is considerably higher than that of the rabbits of the pre-myxomatosis era. For example, in one area where successive generations of rabbits had been exposed to the selective effects of annual natural outbreaks of myxomatosis, the mortality produced among non-immune rabbits taken for laboratory testing by a standardized strain of virus fell from 90 per cent to 25 per cent during a period of only seven years.

It must be emphasized that there are no reports of any British populations of rabbits having a demonstrably enhanced genetic resistance, but evidence is being sought as part of a current research programme. The principle on which the study is based is simple, but its execution is relatively difficult. Rabbits are obtained alive from areas with a history of repeated outbreaks of myxomatosis which apparently produce low kills. Any individuals that have recovered from the disease, i.e., immune rabbits, are discarded. The remainder are then injected with a small dose of a standardized virus, and the mortality rate and survival times are determined. These results are compared with those obtained from control rabbits treated in the same way; the controls that are being used are laboratory rabbits, and wild rabbits collected from an island which has been free of myxomatosis.

Recovery of rabbit populations

After a 90 per cent kill, a ten-fold increase will allow a population to recover completely. Disregarding adult mortality and assuming a 1 : 1 sex ratio, this recovery could be made in one season if each doe produced eighteen surviving young. Although many does will give birth to more than eighteen live young in a single breeding season, many perish before weaning; whole litters are frequently drowned on heavy land and nests may be dug out by badgers. Coccidiosis is a common cause of death in juvenile rabbits and many are taken by foxes, stoats, feral cats and predatory birds. Ecologists in Australia, New Zealand and Britain suspect that such predators can have an adverse effect on the recovery of rabbit populations from low levels, although it is agreed that they have little overall effect when rabbits are abundant. The slow reappearance of rabbits after the first waves of myxomatosis may be attributed to the even greater problems of recovery from a 95 or 99 per cent mortality.

In addition to the mortality factors just discussed, we must consider death from age, from recurrent myxomatosis and by human action. When rabbit populations were high in pre-myxomatosis times, and intra-specific stress was severe, the length of life of wild rabbits may have averaged little more than a year, although their potential life span is much greater. There is some evidence that present-day populations contain relatively older individuals. This may be an indirect effect of repetitive outbreaks of myxomatosis

removing most of the new, susceptible generations and leaving unscathed, in conditions of reduced population pressure, the immune survivors of previous outbreaks. A careful study of the structure of some rabbit populations in terms of age, immunity and known disease history has not been done in Britain, but would be useful. Recent studies of genetic resistance by Helen Vaughan (unpublished work), have shown that in some areas with relatively high rabbit populations the proportion of immune rabbits is very substantial.

It is ironical that today many areas having fairly high rabbit populations are also those subject to frequent outbreaks of myxomatosis. The populations of immune animals are large enough to produce sufficient susceptible progeny to allow the repeated circulation of virus and yet to offset the comparatively high mortality produced among these young. Myxomatosis is doing little more than cull individuals that would otherwise die from other natural causes.

A hypothetical example will help to illustrate how important immunity can be in an area exposed to frequent outbreaks of myxomatosis. Let us start with 100 susceptible rabbits, a virus that produces a 90 per cent case-mortality rate, and a 90 per cent rate of infection. If 90 rabbits are infected, nine should survive and be immune. These nine, with the ten non-infected, susceptible individuals might produce 200 young of which, say, 100 escape the immediate hazards of juvenile life. A second outbreak of myxomatosis with a similar virus and infection rate should leave 9 (or 10) immune adults, 1 non-infected adult, 9 immune juveniles and 10 non-infected juveniles. That is, a breeding stock increased to twenty-nine (or thirty) and with a higher proportion of immunes. Also the stage could be set for the emergence of individuals with enhanced genetic resistance.

The need for human control activities of rabbits should now be apparent. Immune individuals, and of course any genetically resistant ones, will only disappear from the population as a result of age, accident or predation, which includes human predation. Farmers and foresters who have experienced the benefits of a rabbit-sparse environment should need no encouragement to play their part in maintaining a *status quo*, if not improving on the situation. The advent of myxomatosis must be regarded as an occurrence that has made the rabbit problem manageable, but not as one that has given the solution.

References

1. ARMOUR, C. J. and THOMPSON, H. V. (1955). Spread of myxomatosis in the first outbreak in Great Britain. *Ann. appl. Biol.*, **43**: 511-8.
2. MUIRHEAD-THOMSON, R. C. (1956). The part played by woodland mosquitoes of the genus *Aedes* in the transmission of myxomatosis in England. *J. Hyg., Camb.*, **54**: 461-71.
3. FENNER, F. and CHAPPLE, P. J. (1965). Evolutionary changes in myxoma virus in Britain. *J. Hyg., Camb.*, **63**: 175-85.

For fuller accounts of myxomatosis the reader is referred to:

- FENNER, F. and RATCLIFFE, F. N. (1965). *Myxomatosis*. Cambridge University Press, 379 pp.
THOMPSON, H. V. (1961). The history and present situation of myxomatosis. Penguin Books, London, *Science Survey*, **2**: 102-11.

A. R. Mead-Briggs, B.Sc., Ph.D., is a Principal Scientific Officer in the Infestation Control Laboratory's Field Research Station at Worplesdon, Surrey. Most of his research has been concerned with the biology of the vectors of myxomatosis. The contributions that colleagues have made to this article are gratefully acknowledged.

The Small Farm Dairy Herd

A. J. Wynne

THE problem of the small farm is basically one of intensifying production. Many farmers are no longer prepared to accept low incomes and long hours of manual labour. They have learnt the value of both labour and leisure, and expect to share in the amenities of modern life. This change of attitude is one of the factors that have led to the recent decline in the numbers of small dairy herds throughout the country and the parallel decline over the last decade or so in the numbers of agricultural holdings of all sizes up to 300 acres. This does not at all imply that small-scale farming is disappearing in this country. On the contrary, the family farm with little hired labour is still the dominant form of organization and is particularly strong in dairy farming.

Nevertheless, there are many problems involved where cows are kept on small farms. There is a continual struggle to keep up with technical change and to expand the output per man-hour which is one of the bases of increasing productivity. The difficulties can best be overcome if they are tackled systematically. There are two aspects of productivity which are of great importance on the dairy farm: the productivity of the stock and the productivity of the land. These are most conveniently dealt with separately.

Importance of productive stock

It is now almost commonplace that profits depend on highly productive stock. With pigs and poultry it is necessary to have both high physical production and a good food conversion ratio. The same is true of cows, but both aspects are more complex. Physical production includes both milk, with seasonal and quality price variations, and calves of very dissimilar values. Food conversion involves pasture grass, conserved grass, kale, roots and concentrates of extremely divergent costs. Productive stock must have their production measured over a strictly defined period of time (normally a year) if valid comparisons are to be made. Now that we have both seasonal and quality variations in milk prices, and in order to include the value of calves produced, it is convenient to express output in £ value per average

cow (i.e., the total value of milk produced and calves produced during the year, divided by the average size of the dairy herd during the same period). To work out the food conversion ratio it is also necessary to express the foods in common terms such as cost of production. Our efficiency factor would then be: total output per £100 food costs.

While it is comparatively easy to calculate the value of production per cow per year, the input-output ratio involves some detailed costings or estimations. If this is not practicable it is well worth recording the concentrate usage, since cake is the most expensive of all foods and experience shows that its excessive use is a frequent source of unsatisfactory results.

TABLE 1

Input-Output Standards in Milk Production*

Annual yield of milk per cow	Value of output per cow	Total food costs per cow*	Output per £100 food costs	Margin over food costs
<i>gal</i>	<i>£</i>	<i>£</i>	<i>£</i>	<i>£</i>
800	136	55	247	81
900	152	60	253	92
1,000	168	66½	253	101½
1,100	184	74½	247	109½
1,200	200	83	241	117

*Figures derived from the *National Investigation into the Economics of Milk Production*. Food costs include home-grown foods and grazing charged at cost of production.

Table 1 shows the normal trend of input and output with increasing yields per cow (average *annual* yields), and assuming a calf value of £10. It will be seen that with yields up to somewhere between 900 and 1,000 gallons per cow, the food conversion ratio improves so that the margin above food costs is increasing. Above this yield the conversion ratio shows a tendency to fall, but not sufficiently to prevent a further increase in the margin over food costs. This is in line with practical experience. With increasing yield the maintenance ration is spread over a greater gallonage, thus reducing unit costs, but with yields above about 950 gallons this is counterbalanced by the need to use more of the expensive foods.

It is emphasized that the figures in Table 1 are average values which milk producers should not find it difficult to achieve. At any point on the table there are two possible ways of increasing margins: either by increasing yields per cow or by improving the food conversion ratio. The figure in the last column shows the changes in margins resulting from improving one of these items only.

Table 2 suggests standards for concentrate feeding which ought to be achieved by a milk producer who takes intensification seriously. The standards are based on the assumption that maintenance plus the first gallon will be produced *on average* from either pasture grass or other roughages such as kale, silage and hay. Usually more than one gallon will be produced from young grass and perhaps only half-a-gallon during the winter months.

TABLE 2

Concentrate Feeding for Production above the first Gallon

Yield per cow	Total quantity fed per cow	
	at 4 lb per gal	at 3½ lb per gal
<i>gal</i>	<i>cwt</i>	<i>cwt</i>
800	17½	15½
900	21½	18½
1,000	24½	21½
1,100	28	24½
1,200	31	27½

Land productivity

The second part of the intensification process concerns the use of the land. Unless the land is used efficiently there can be no hope for the smaller farmer who wants a modern standard of living. In the old days three acres were needed to keep a single cow. Today the average is about two acres. The more intensive dairy farmers do much better than this, so that for present conditions we can suggest that 1½ acres per cow is probably excessive and on good land the aim should be 1¼ acres per cow or 25 acres for 20 cows. Unfortunately not all dairy farms are capable of this.

In the past many dairy farms were established on poor-quality land within hauling distance (by horse) of their urban markets. Some of these farms remain today, but now they are in active competition with milk producers on better land. Their reason for existence has gone and the sooner they realize it the better. In fact, many such farms have given up the production of milk in recent years.

For the rest, the degree of intensification required involves considerable changes compared with some of the traditional dairy systems. The essence of the plan must be to grow a high-quality diet for the cows, and to do this in such a way that the cows can utilize the food produced. Unfortunately, this is by no means a straightforward matter. It is necessary to produce plentiful, nutritious pasture grass for the whole grazing season and to conserve a good-quality roughage for winter feeding. In the wetter regions silage-making has many advantages, both because under those conditions it is easier to make a good-quality product than by haymaking, and because it is easy to combine with good pasture management. The main disadvantage is that it is hard to avoid wastage of nutrients whatever the method of silage-making adopted. If haymaking is preferred, it is still essential to harvest a plentiful crop of high quality. It must be admitted that we are still looking for better methods of grass conservation that will make the best use of the excellent material we can grow.

Making the farm more productive

Most small farms are also short of capital. The process of intensification must, therefore, provide for the easiest way to increase the farm production potential. The first step is clearly to tackle grassland output, both as regards quality and quantity. This first step can bring direct benefits in cost reduction very quickly by saving costs of purchased foods and thus begin to produce

the income required to increase the stocking of the farm. The reverse process of buying extra stock before the grassland has been improved to carry them can be disastrous. Alongside this comes improvement of the dairy herd, both from the point of view of milk output and from that of utilizing the improved grass and grass products. The quickest way to improvement in quality is by judicious culling and the careful selection of replacement stock. This may prove expensive, but fortunately many cows are happy to change from a diet relying almost wholly on cake for the production ration to one where cake is fed only to high yielders at the peak of their lactations. Buying replacements is also the quickest way to increase herd size, but if capital shortage prevents this, it will be possible, as an interim measure, to use part of the increased food production to rear calves from the best cows. This should not be regarded as an essential or permanent part of the system. Rearing is a less intensive enterprise than milk production and cannot be expected to give the same returns. Nevertheless, it is an enterprise that can usefully be fitted in during the expansion process and which can help materially in the improvement in the capital structure of the farm.

At some stage the buildings will have to be altered to make possible the handling of more cows without increased labour. This involves decisions that are best left until some progress has been made in the intensification of land use. When some idea has been formed of the future potential output that can be obtained from the farm, plans can be made for the future stocking and housing of the stock. By then income should already be rising and an approach to a bank manager for a loan will be more likely to meet with success than in the early stages of expansion.

This article has been contributed by **A. J. Wynne, B.Sc. (Lond.), N.D.A.**, who is a lecturer in agricultural economics in the Department of Agriculture at Leeds University.

Wild Oats

A Problem for Cereal Growers

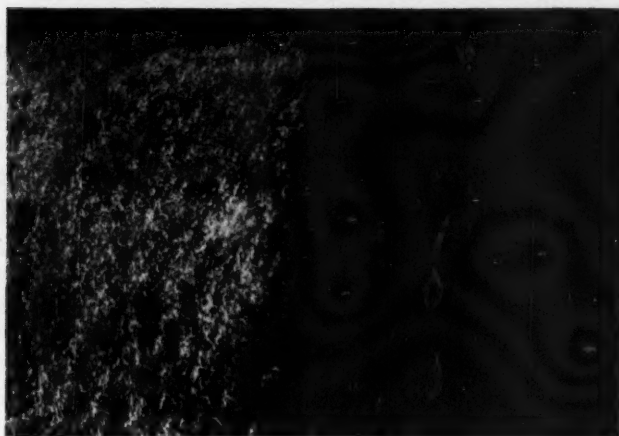
Stanley A. Evans

As a youth I can remember the look of scorn on an old farmer's face as he pointed out a few wild oats in a neighbour's crop. 'There's a certain cure for them', he added, 'Two root crops in succession'. The area in which this occurred has now its share of wild oats, like most other arable areas, and there is today, unfortunately, no simple cure. The principle of getting rid of wild oats is clear: the viable seed in the soil must be exhausted and any wild oat plants which germinate must be removed before they have a chance to put seed back into the soil. It is possible to clean up a field in this way but, as wild oat seed may remain viable in the soil for seven years or more, patience is required. The long ley, for example, allows heavy populations of seed virtually to disappear by the time of ploughing after seven or eight years; but long leys are not part of today's farming in the areas where wild oats are a nuisance.

Cultivations

Another possibility is to use the fact that wild oats germinate at a definite period in the year. There are two types of wild oat. One germinates in the winter: cultivations for a spring crop destroy the seedlings and a succession of spring crops will clean out this type of wild oat. The more common variety germinates partly in the autumn but mostly in the spring. Germination after the middle to end of April is usually negligible. Thus the sowing of a crop after this time gives a crop free of the weed. The effects of a succession of late-sown crops has been demonstrated dramatically in an experiment at Boxworth Experimental Husbandry Farm (see illustration). Late sowing is not something which may always be satisfactory, particularly on lighter soils where the loss of soil moisture might seriously endanger the establishment and growth of the crop. Stirring up the soil while waiting does not improve wild oat control and the extra loss of moisture will certainly affect the late-sown cereal. The soil can be cultivated in early spring and left alone until the seedbed for the crop is prepared, at which time the wild oats that have germinated will be killed. Loss of yield from late drilling can be counted as

A succession of late-sown spring barley crops has eradicated wild oats (right) compared to normal sowing (left)



the cost of controlling wild oats. If the loss is greater than 10 or 15 per cent, it is probably cheaper to use a herbicide.

Crops which can be removed before the wild oats shed their seed, e.g., an arable silage crop, or crops which are well cultivated, like the old farmer's root crops, can all prevent seed from getting back into the land. By rotation and suitable cultivations wild oats can be eliminated. The modern farmer, however, looks for a means of control in a system of farming that usually allows little by way of cultural methods of control. So he turns to chemical weed-killers. At present, however, the weed-killers available have their limitations. They tend to be palliatives rather than cures, and it pays to prevent wild oats ever gaining a foothold.

Roguing

Roguing, when wild oats are few in number, can prevent trouble later on; but action must be taken as soon as any wild oats are seen for they soon build up, within a year or two, to the stage where roguing becomes impracticable. One plant is capable of producing over 6,000 seeds. In removing wild oats, the whole plant must be pulled out, removed and burnt. Seed at the milky stage can be viable.

Where wild oats already exist, as they do in most areas that grow cereals intensively, there are few things that can be done to help keep them in check, other than using chemicals. It is most important to have a good competitive crop. Winter cereals should be sown early and got away to a good start by the use of appropriate fertilizers, so that the crop is ahead of the wild oats. Late sowing, as already discussed, may be more appropriate to spring cereals. Stubble burning or cultivating do little to help wild oat control. Evidence from Boxworth Experimental Husbandry Farm suggests that it is best to leave stubble untouched so that birds can get at the wild oat seeds.

Chemical control

The chemicals available are several, but for cereal crops there are only two. These are barban and tri-allate. It is remarkable that chemicals will kill one type of cereal plant but not another, and indeed the careful use of these chemicals is imperative. The selectivity between weed and crop is easily impaired by inattention to detail.

TABLE 1

Chemicals available for wild oat control

(Consult manufacturer for details of use and follow his instructions)

<i>Crop</i>	<i>Chemical</i>	<i>Applied to</i>	<i>Stage of crop</i>
Cereals	Tri-allate	Soil	Pre- or post-drilling
	Barban	Foliage	Post-emergence
Field beans	Barban	Foliage	Post-emergence
Peas	TCA	Soil	Pre-drilling
	Propham	Soil	Pre-drilling
	Tri-allate	Soil	Pre-drilling
	Barban	Foliage	Post-emergence
Potatoes	Paraquat	Foliage	Pre-emergence
Sugar beet	TCA	Soil	Pre-drilling
	Propham	Soil	Pre-drilling
	Di-allate	Soil	Pre-drilling

The chemicals are used in contrasting ways. Barban is applied to the foliage of wild oats, whilst tri-allate is mixed into the soil surface. Barban may be used on most varieties of winter wheat, spring wheat and certain varieties of spring barley but not on Proctor, Impala, Abed Deba, Maris Badger, Freja and several others. The stage of growth of wild oats is important. They must have between 1 and 2½ leaves per plant (a 'half' leaf being one only half its final length). Wild oats tend to germinate over a period of time and from varying depths, even from as deep as 8 or 9 inches, so that wild oats can be at very different stages of growth at any one time. The aim should be to spray when the first flush of wild oats has reached the correct stage, because those coming later will be suppressed by the crop itself. Crop competition is very important in helping the work of the herbicide and in crops like peas or beans, where competition against the wild oats in the early stages of growth of the crop is not likely to be severe, the dose of chemical is normally increased, although this makes the treatment rather expensive. There are restrictions on the time of spraying winter wheat and on the use of other herbicides likely to be applied within a few days of spraying barban.

Tri-allate is volatile and must be mixed into the soil straight away after spraying. It may be used on any cereal crop, except oats and rye, without restriction as regards to variety. Spring barley is more resistant than spring wheat. The manufacturers give careful advice on using this material and their conditions of sale must be noted. It is necessary to get the chemical mixed into the top inch or two of soil and to drill the crop an inch below the treated layer. Good soil conditions and a good drill are obviously important. Some thinning of the crop sometimes occurs but this can be compensated for by having a variety that tillers readily or, with farmers who normally use comparatively low seed rates, by slightly increased rates of sowing.

Neither herbicide, then, is ideal and neither gives a complete control of wild oats, although tri-allate tends if anything to be rather more effective than barban. Both can leave plants which can eventually return quite a lot of seed to the land. A comparison of the two herbicides is given in Table 2.

The cost

The cost of herbicide treatment is fairly high and something in the order of 10 per cent or greater improvement in yield is required to cover the cost. But

TABLE 2

Comparison of barban and tri-allate for use on winter wheat, spring wheat and spring barley

BARBAN	TRI-ALLATE
May not be used on certain varieties of winter wheat or spring barley.	No restriction regarding crop variety.
Timing is critical.	No problem of timing.
Soil conditions are not important (but in autumn or early winter land must be able to carry a tractor and sprayer).	Good tilth in seedbed is necessary.
Weather can interfere with spraying.	Weather is not so important except in so far as it interferes with the whole process of sowing the crop.
Work comes at a time when labour demands perhaps not great.	Adds extra work load at a busy time (herbicide must be incorporated within an hour or two of spraying).
Crop competition is very important.	Crop competition is less important.
Safer on crop when used on correct variety at correct time.	Possibility of thinning the crop a little.
Cereal may be undersown after spraying.	Cereal may not be undersown.
Efficient distribution of spray is essential: good nozzles important.	Soil incorporation aids distribution of herbicide: minor deficiencies in spraying may be masked.
Some competition occurs before spraying takes place.	Competition minimal as wild oats are killed before they emerge.
Size of problem can be judged before deciding to spray.	Assessment of problem can be based only on past experience.

wild oats, particularly at high densities, can affect cereal yields quite markedly and it seems that it may pay to spray once there are something like 10 to 15 wild oat plants per square yard. It is impossible to be precise about this because the effects of competition vary with the crop, its health and vigour, the season, and so on. It is possible to get yield improvements from spraying with as few as 4 or 5 wild oats per square yard.

The effect of continued spraying of cereals against wild oats will depend upon the effectiveness of each treatment. Progress in the elimination of the weed will be slow so long as the sprays leave some plants to survive and shed seed. The farmer cannot look for a rapid cure by this means. No doubt one day even more efficient herbicides will be available and we shall be more readily able to beat what is, at present, one of the cereal grower's most troublesome weeds.

The author of this article, **Stanley A. Evans, B.Sc., Dip.Agric.**, is the N.A.A.S. Liaison Officer with the Agricultural Research Council's Weed Research Organisation at Kidlington, near Oxford.

Sheep-handling layouts

J. F. Williams-Wynne

THERE were sheep before Noah. Men have tended sheep since the dawn of time. They have shorn them for their wool, skinned them for their hides, they have cooked and eaten them for nourishment. But in all those thousands of years they have only lately come round to thinking much about handling them. There are two probable reasons for this. The first is that there has until recently been abundant cheap labour, so no one ever had to bother about making anything more elaborate than a simple sheepfold or pen. The second is that ever higher rates of stocking have led to the risk of epidemic disease, and forced farmers to handle their flocks more often, dosing, crutching, injecting and pedicuring as required.

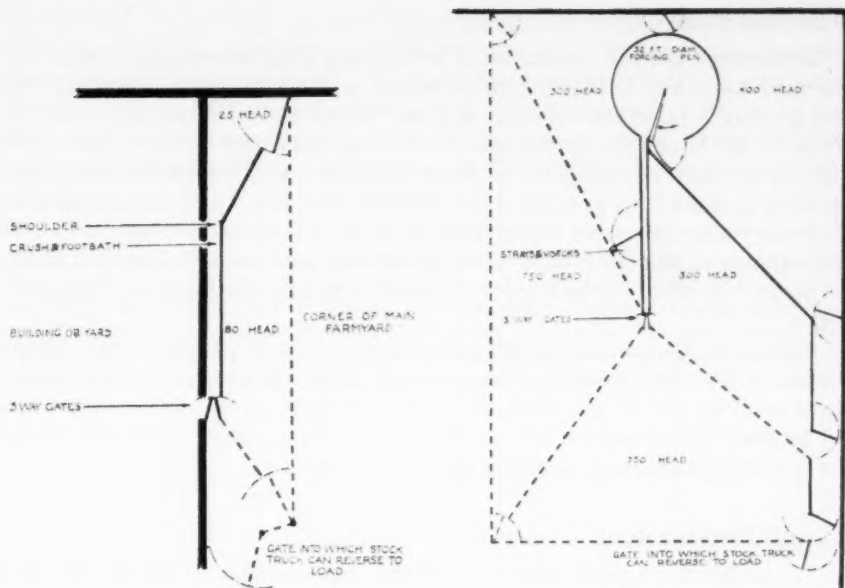
But times change. First the Australians and New Zealanders, hard pressed to handle their enormous flocks with little help, started to work out systems of pens and crushes and races; and now we, here in Britain, are having to get down to it too. For we no longer have a crowd of men, women, children and dogs to help us.

Basic principles

There are two facts which are absolutely fundamental when designing sheep-handling layouts. The first is that sheep can move about on their own four legs. The second is that, within certain obvious limits, sheep can think for themselves. It follows, therefore, that the greatest possible use ought to be made of these two characteristics—one might indeed call them virtues!

Let us consider first this attribute of natural wit. Sheep will tend to move towards food, freedom or a friend in the form of another sheep or a shepherd whom they know is accustomed to feed them. And they will move away from anything which frightens them. These facts may seem so obvious that it is unnecessary to mention them; but people often forget how mobile sheep can be and how obtuse they can appear to be on occasion. But it is no easier to get sheep to go where they do not want to go, than it is to make water flow uphill.

So it is that, when designing a sheep-handling layout, care should be taken to use solid partitions in the places where you do not wish the sheep to see out, and open-work fences where you do. Thus they can be 'funnelled' towards the field to which they want to go—towards, in fact, freedom; or they can be decoyed towards another sheep or to the troughs where they are



Layout for lowland flock

Layout for hill flock

(Dotted lines represent 'open' fencing. Solid lines represent walls)

customarily fed. These are the 'carrots' towards which they will want to go, but behind them, to keep them flowing steadily—through a foot-rot bath maybe—there is much to be said for having a 'stick' in the form of a dog or a noisy, banging gate from which they will shy away. The skilled shepherd will very soon discover just how much carrot must be shown and how much fear must be engendered to keep the flock moving at the right speed, for one does not want a stampede any more than a stoppage.

At this point, although the basic principles remain the same, it may be advisable to split the subject into two, and to consider the problems of the hill farmer and the lowland farmer separately.

The lowland flock

The lowland farmer needs very little in the way of sheep-handling pens because he can bring his flock in field by field, in small numbers. He can treat them and send them back a few score at a time. But there are, nonetheless, some features which he could well consider.

The first is that, as he is probably going to have his flock close-folded, he will have to run through them at fairly regular intervals. Hence the sheep pens will be used a good deal. He can, therefore, justify investing quite a bit in concrete underfoot. Again, because he will probably want to go through the flock on days when other farming jobs are impossible, he can justifiably have a roof over the working pen, the race and the foot-rot bath.

Other than these two items there is very little need for anything large or elaborate. In fact the inclusion of the pens with some gates and walls in a corner of the farmyard may warrant concreting an area which has hitherto not been done.

The hill flock

By contrast the hill farmer has a completely different problem. Many hill farmers have their hill unfenced, or at best in one huge patch. On many hills the grazing is poor but the sheep are acclimatized to it. When he gathers his flock he has to collect every single sheep, bring the whole lot down, treat each animal (or shear it or crutch it as the case may be), and return it to the upland grazing as quickly as possible. If he keeps them down a moment longer than necessary they will either starve in the pens or, if he turns them out into even the poorest in-bye field, some of them will eat too much and start to scour, or worse. He must, in fact, have facilities to handle the lot in the minimum time.

But where the lowland farmer may use his pens many times a year, the hill farmer will probably only use his complete layout on half-a-dozen occasions. Less concrete will be required, though larger pens and more pens are likely to be desirable. Concrete can be confined to those places where the farmer notices that in use there is undue wear under foot.

Capital investment

To qualify for a grant under one of the improvement schemes one has to submit a complete and comprehensive plan, and have it approved before starting work. But to know what one is going to want in the way of a sheep-handling layout is far from easy. In fact, therefore, however nice grants may be, there is much to be said for doing the work piece-meal and without grant aid. It may seem haphazard and unbusinesslike, but I am certain that anyone putting in a really comprehensive design today will be able to think of at least two improvements within the year.

Another thought while on the subject of capital outlay. The New Zealand and Australian farmers have taken all this for granted for years. We can learn much from them. But when looking at their systems it is worth remembering that their land probably cost less than £5 an acre to buy outright. Ours may be worth nearly as much a year, so our stocking rate on any but the poorest land has got to be a lot heavier than theirs. And this of course means that we shall have many disease problems which seldom worry other people. We shall have to go through our sheep far more often than they do. We are probably justified, therefore, in spending more on a layout than they would do. As yet there is no ideal blueprint. There is still a great deal to be learnt and so my advice would be 'proceed with caution'.

The future

It is difficult to forecast just how many years will pass before someone produces a device which reads a ewe's serial number, prints it on a tape, weighs her and prints that too, and gives a full report on her condition, worm infestation, state of teeth and quality of fleece! But there are machines in industry which are doing far more complex jobs, and doing them with complete accuracy. It is all a matter of relative cost. Just as soon as the cost of a man's time exceeds a certain figure then, if the price of lambs and wool justifies the outlay, someone will demand mechanization. It could come sooner than some people imagine.

But even if electronic selection apparatus does not come for a generation, it cannot be long before men cease wading into a pen full of sheep to draw the

fat lambs, or to draft or cull. Only the smallest farmers will be able to afford this for much longer and they, if they ever pause to cost their own time, will abandon the custom overnight. Skilled help is going to become ever more scarce. Farmers will have to handle their flocks themselves on more and more farms. Time is going to become increasingly precious. Sheep-handling layouts are likely to be interesting news on many British farms for some time to come.

This article has been contributed by **Col. J. F. Williams-Wynne, D.S.O.**, who farms 1,250 acres in Merioneth and who plays an active part in the agricultural affairs of that county. In 1965 he was one of the judges in the Farm Buildings Competition organized by the Country Landowners' Associations and the *Farmers Weekly*. He has been Chairman of the Advisory Committee of the Experimental Husbandry Farm, Trawscoed, for the past eleven years, and has been a National Parks Commissioner since 1961.

Salmonellosis

in Cattle

E. A. Gibson

BY NOW most stockowners know that *Salmonella* infection is an important cause of losses in calves and one that is apparently becoming more common. It is less well known, however, that the infection also affects adult cattle, and that this adult infection is the starting point of some of our calf troubles. One of the purposes of this short article is to show how this occurs.

The salmonellas form a large group of bacteria, some 1,000 in number, all of which are capable of causing disease in man, animals or birds. Many different types of salmonella have been found in cattle from time to time in various countries but—and this is important—under British conditions only two are of practical day-to-day importance. These are *Salmonella dublin* and *Salmonella typhimurium*. Other types may be found occasionally but do not often cause actual illness.

The two organisms

These two organisms, *S.dublin* and *S.typhimurium*, behave quite differently. *S.dublin* is essentially a pathogen of cattle. It is occasionally found in other

animals, and can cause serious outbreaks of abortion in sheep, but this is uncommon compared with its daily occurrence in cattle. It follows from this that any outbreak of *S.dublin* infection in cattle has probably originated from other infected cattle. *S.typhimurium* is different in that it seems able to infect practically all species of birds and animals—and man—with equal facility. Because of this, outbreaks in cattle may originate either from infected cattle or from other species.

Another difference between these two organisms lies in the geographical distribution of the infections that they cause in adult cattle. *S.dublin* seems to have established itself in adult cattle in certain areas, and in one area where a study of the disease incidence has been made, $\frac{1}{2}$ –1 per cent of cattle were shown to be excreting *S.dublin* in their faeces. Similar areas undoubtedly exist elsewhere in Britain but have so far received less attention. Other 'endemic areas' have been described elsewhere in Europe, and it seems both from observations there and in Britain that these are usually areas where rough grazings are common, where cattle drink from streams or dykes and where liver fluke infection also occurs. In contrast to this, *S.typhimurium* infection occurs in adult cattle throughout Britain, but at a much lower incidence than *S.dublin*.

Clinical signs

The two infections produce similar clinical signs in adult cattle—dullness, inappetence, high temperature, and profuse diarrhoea with fluid faeces that may contain mucus and blood. Many cases die. With *S.dublin* infections, the animals that recover either naturally or with the aid of treatment invariably continue to pass large numbers of the organisms in their faeces for many years, if not for life. Infection with *S.typhimurium* can produce a similar 'carrier' state, but this is usually for a much shorter time. Other cattle, with no history of clinical illness, may also excrete *S.dublin* in their faeces, presumably as the result of infections that have been so mild as to pass unnoticed. Sometimes the organisms are passed only intermittently. Still other animals carry salmonella organisms in some internal organ, such as a lymph gland, and do not normally pass them in their faeces unless 'stressed' by some other disease or by an occurrence such as a difficult calving.

It will be appreciated that these 'carrier' cows that are excreting salmonella organisms in their faeces can act as a source of infection either to their own calves or to others. Some of these calves may die suddenly from a generalized infection. Others may show illness of varying severity, ranging from a rapidly fatal diarrhoea to a very mild illness. Generally speaking, the outbreaks in calves on these breeding farms are not very severe. The number of calves at risk is often small and it also seems that the individual attention they receive, and the absence of dietary and other upsets, help to prevent any infection from gaining the upper hand. It is noteworthy, however, that when infection does occur among calves on these farms, it can invariably be shown that one or more 'carriers' are present in the adult herd.

The picture seen in calf-rearing areas, such as East Anglia, is very different. In these areas calves are usually kept in big groups brought together from many different breeding farms for intensive rearing for beef. It is not uncommon for 50 calves to come from 50 different sources. Under these circumstances losses from salmonellosis can be severe, a 20 per cent to

30 per cent mortality having been recorded. In contrast to the position found in the endemic areas, very few of these outbreaks can be traced to the presence of 'carrier' cows. Indeed, they commonly occur on premises where there are no adult cattle. Instead, it seems that in most cases the infection comes in with the purchased calves. This is not to say that the calves that introduce the infection have necessarily acquired it on their home farm. Under present-day methods most calves face the risk of infection on a number of occasions—in lorries, collecting centres, markets, or dealers' premises. Some calves are exposed in a succession of markets before they are sold, and it is self-evident that each exposure of this kind offers additional opportunities for infection with a variety of disease organisms.

This brings us back to the different distribution in nature of *S.dublin* and *S.typhimurium*. Since *S.dublin* is chiefly an infection of cattle, any contamination of lorries, markets and other premises with it must almost certainly come from infected calves or cattle. In contrast to this, contamination with *S.typhimurium* could originate either from cattle or from other animals or from birds. Another effect of repeated exposure in market is that the travelling, chilling and dietary changes that are so often involved reduce the calf's resistance to any infection that it encounters. This is important because it seems that stress of this kind can turn what would otherwise be a mild un-noticeable infection into a serious and even fatal illness.

Prevention

What can be done to prevent the occurrence of salmonellosis in calves? It follows from the above that if infection is occurring in a self-contained herd a search should be made to see whether any 'carrier' cows are acting as the source of the trouble. Prevention is more difficult when calves have to be purchased. Ideally one would like to see calves bought from just one or two dairy farms and taken direct to the calf unit, but unfortunately this is rarely practical. Failing this, the calves should come from their home farms by as direct a route as possible, and it is especially important to avoid buying any that have been through several markets or that come from the kind of dealer whose premises are never empty. Having chosen a calf that has had a fair deal, it should be given a fair deal at home. It should be kept warm and dry, not overfed, and its stomach should be rested for the first 24 hours by giving it only glucose and water. As mentioned above, this kind of care is most important in deciding whether the calf will be able to cope with any infection that it has acquired.

A recent step forward has been the development of a vaccine against *S.dublin*. This seems to be very helpful in preventing serious outbreaks of this infection, and may also give some protection against *S.typhimurium*. Many calves are vaccinated before they travel to the rearing areas. This is very much to be encouraged, and could very usefully be made a condition of sale, both by individual purchasers and, more important, by calf buying groups. I would also like to see these groups seeking assurances that the breeding herds are free of 'carriers'.

The general system of the calf unit should approach as closely as possible to that of 'all-in, all-out'. This prevents the spread of infection from one age group to another and facilitates proper disinfection. Even if the whole site cannot be treated in this way, every endeavour should be made at least to fill

the calf house at one go rather than by buying-in weekly batches. Similarly, the newly-purchased calves should be put into clean, disinfected premises and kept in isolation from older batches.

Diagnosis and treatment

If, despite these various precautions, salmonellosis is suspected in a batch of calves, diagnosis and treatment are, of course, matters for the veterinary surgeon, especially as laboratory examinations may be necessary to confirm the diagnosis and to test the sensitivity of the organism to various drugs and antibiotics. Good nursing, however, still has an important part to play alongside the more specific forms of treatment. It must also be remembered that both types of salmonella can infect man. *S.typhimurium* is, in fact, the chief cause of human food poisoning and although infection with *S.dublin* is much less common in man it can, when it does occur, cause serious illness such as meningitis or septicaemia. As in many diseases, children are more susceptible than adults, and they should therefore never be allowed to fondle sick calves. Dogs can also acquire the infection, and should be excluded from the calf house. Whenever possible, sick calves should be kept in isolation and looked after by a separate attendant. In any case a separate pair of rubber boots and a coverall or 'plastic mac' should be kept in the sick bay for use only in there. These should be disinfected at least twice a week. The attendant should have a good wash before tending other stock and, more especially, before going home. The sick bay should be thoroughly cleansed and disinfected between occupants, to prevent the build-up of infection and to ensure that disease is not transmitted from one occupant to the next.

Once the outbreak is over, the building should also be given a thorough clean-up; otherwise the salmonella organisms may survive for long periods, up to 6 or 12 months, and still be capable of infecting another batch of young calves. During an outbreak the organisms become more widely distributed than is generally realized, and can be found in the dust on top of beams and ledges as well as in those areas that are obviously soiled with faeces. Because of this the whole building should be emptied, cleaned and disinfected, and the process completed by fumigating with formalin or by fogging with a disinfectant aerosol or fine spray.

The problem of salmonellosis in calves appears to be increasing. I have tried to show, however, that care in the choice of calves, careful stockmanship and use of the new vaccine can do much to limit its spread and to minimize its effect. This is, moreover, a fruitful field for co-operation between the breeder and rearer.

The author of this article, E. A. Gibson, Ph.D., B.Sc., M.R.C.V.S., is the Veterinary Investigation Officer in charge of the Ministry's Veterinary Investigation Centre at Norwich.

Fodder Radish or Rape?

A. G. Boyd and I. A. Dickson

THE Welsh Plant Breeding Station Report for 1962 referred briefly to a comparison of several forage crops grown in exposed upland conditions. One of these, fodder radish, had produced four times as much dry matter as giant rape. Subsequent reports gave results from later trials in which similar yields were obtained on hill land, but where the yield advantage of radish over rape was reduced to only 33 per cent on low ground. In both situations the new crop was quick to develop and was unaffected by clubroot. Early August was the best sowing time to obtain a good leafy crop without excessive shooting and flowering. At the leafy stage the crop was palatable to sheep and more digestible (according to laboratory studies) than rape or grass. A disadvantage of flowering was the high proportion of waste when grazed by sheep. Reports from the National Institute of Agricultural Botany over the same period indicated that in 17 trials Raifort Champetre fodder radish had out-yielded giant rape.

These reports made it clear that fodder radish could be of considerable interest to farmers in south-west Scotland and elsewhere, where rape is used to finish lambs, mostly off the hill, for the butcher. Some rape is grown on fertile low ground, but much of it is on higher, more exposed land where low yields, due to climate or the presence of clubroot, are not uncommon. The West of Scotland Agricultural College therefore decided to carry out some experiments, and a number of replicated trials were established in 1964 to compare fodder radish and giant rape with and without Italian ryegrass. The yield estimates from three of these trials are shown in Table 1. Over all treatments the mean dry-matter yield of radish was 9 per cent above that of rape, although if the pure crops only are considered, this difference was 16 per cent. The inclusion of Italian ryegrass produced a small increase in yield from the mixture with rape, but a decrease of 7 per cent from the fodder radish and ryegrass mixture. This was probably due to the reduced seed-rate of fodder radish, as little ryegrass was seen in these plots. The high dry-matter content of both crops in the Perthshire trial was due to more advanced maturity, although owing to the development habit of these crops, an exact series of growth stages is difficult to define. For example, the fodder radish in the Perthshire trial was flowering and seed pods had formed, while the rape was a full crop which a farmer would have begun grazing some three weeks earlier. The other two trials, in which the radish was just beginning to flower, were harvested relatively earlier.

TABLE 1

Content and yield of dry matter in three trials, 1964

Crop (and seed-rates in lb per acre)	Percentage dry matter			Dry matter (cwt per acre)		
	Kirk- cudbright	Lanark	Perth	Kirk- cudbright	Lanark	Perth
Rape (10)	8.8	10.5	13.6	22.5	27.8	33.1
Fodder radish (15)	8.2	8.8	13.2	25.3	31.7	39.4
Rape + Italian ryegrass (6 + 10)	9.2	10.8	13.6	19.8	35.1	32.2
Fodder radish + Italian ryegrass (9 + 10)	8.4	9.5	12.8	23.2	26.6	39.4
Standard error of the difference between two means	±0.4	±0.7	±1.9	±1.4	±3.2	±6.0

The seed-rates are based on local farming practice

Plant development

To study plant development during the growing period, observation plots of the two crops were sown on the College Farm, Auchincruive, at 14-day intervals from 9th June to 15th September. June-sown radish grew quickly and flowered in six weeks; July-sown radish flowered after eight weeks, and sowings after mid-August had not flowered by December, although they had produced a useful amount of green material. Clubroot severely stunted growth in the rape plots but left the radish plants unaffected. October frosts had surprisingly little effect on the radish plants, but more severe frosts killed off the plants later in the winter.

In addition to these trials, one-acre plots of giant rape and fodder radish were grown at Auchincruive in 1964 and again in 1965 for lamb finishing trials, the results of which are discussed later. The mean yields of dry matter were estimated from sample cuts in each crop, and in both years radish gave 12 per cent more dry matter than rape:

	Dry matter (cwt per acre)	
	1964	1965
Rape	28.1	35.4
Fodder radish	31.6	39.5

Further replicated yield trials were carried out in 1965 in Argyllshire, Ayrshire and Kirkcudbrightshire, and compared giant rape with four fodder radish varieties—Raifort Champetre, Ringot Rapide, Siletta and Slobolt. Mean yields for the three trials are given in Table 2. Over all four varieties, radish outyielded rape by 37 per cent on a dry matter basis; the margin varied from 15 per cent from Slobolt to 50 per cent from Ringot Rapide. In composition, the varieties fell into two groups, Raifort Champetre/Slobolt and Ringot Rapide/Siletta. In each group varieties had a similar content of dry matter and nitrogen, and the dry-matter yield of Ringot Rapide and Siletta was almost identical. Observations made during the growing period of all the 1965 trials indicated that Raifort Champetre and Slobolt took 11 to 12 weeks to reach the flowering stage, whereas Ringot Rapide and Siletta had

This photograph, taken on a farm in Kirkcudbrightshire in August, 1964, shows the comparison between rape (centre) and white-flowering fodder radish (right and left)



reached this stage in only 8 weeks and by harvest time (11 to 13 weeks) bore a profusion of seed pods. It would seem, therefore, that the higher percentage of dry matter and lower percentage of nitrogen of the latter varieties is associated with a more advanced stage of maturity, which is probably responsible for the higher yield of dry matter of these two varieties.

TABLE 2

Mean yields from three trials in Argyllshire, Ayrshire and Kirkcudbrightshire, 1965

Variety	Fresh material (tons per acre)	Mean % dry matter	Dry matter (cwt per acre)	Mean % nitrogen	Nitrogen (lb per acre)
Giant rape (control)	8.3	10.4	17.3	3.3	65
Raifort Champetre	14.4	8.4	23.4	3.6	95
Ringot Rapide	14.3	9.3	26.0	3.0	89
Siletta	13.4	9.4	25.4	3.1	87
Slobolt	11.9	8.6	20.0	3.5	79
Standard error of the difference between two means	± 1.5	± 0.5	± 1.5	± 0.1	± 6

Relative maturities

A more-detailed study of the relative maturities of these four varieties was made in small plots sown at monthly intervals from 9th June to 31st August. The June-sown plants developed very quickly; Ringot Rapide and Siletta flowered in seven weeks and Raifort Champetre and Slobolt after ten weeks. When sown on 7th July, Ringot Rapide and Siletta flowered in eight weeks while the other two took eleven weeks to reach this stage. When sowing was left until the beginning of August, flowering was delayed in Ringot Rapide and Siletta until October (11 weeks), and Raifort Champetre and Slobolt had not flowered in mid-November when severe frost killed off the radish plants. As in 1964, the rape plants in these plots were severely checked and in some cases killed out by clubroot, but the radish plants were unaffected.

The most frequent comment from farmers and observers associated with the various trials concerned the increasing wastage of radish by sheep as the flowering stage was passed. Young plants were eaten cleanly; once flowers appeared, only the more succulent lower leaves were eaten, and as pods formed the sheep showed less and less interest in the crop, except perhaps as shelter.

From this evidence it appears that the usefulness of fodder radish in south-west Scotland is limited to situations in which the young, leafy plant can be grazed, as the extra dry matter produced by older plants is nullified by the high proportion of waste. To obtain a reasonable yield from a non-flowering crop, which can be grazed over a useful period of time, late sowing will generally be necessary. Early August is often unsuitable for sowing on hill farms due to pressure of other work and the likelihood of wet weather, and there is the further danger that unduly delayed sowings will result in very low yields. One possible solution is being investigated at the Welsh Plant Breeding Station, where strains with a longer vegetative growth period have been selected. If these show the same productivity as present varieties, they may introduce sufficient flexibility to sowing time and grazing period to give fodder radish a practical place on farms in the west of Scotland. While the rapid growth habit and clubroot resistance of fodder radish may be advantageous in some circumstances, there remains the question of its potential for finishing lambs.

The 1964 and 1965 experiments were carried out with Blackface wether lambs. Initially in 1964 the relative palatabilities of rape and fodder radish sown on 6th July were tested by allowing a group of 24 lambs access to both crops, with a lie-back area of grass. The test commenced on 5th September, and twice-daily observations were made on the number of lambs feeding on each crop. During the first seven days, twice as many lambs were seen grazing on the fodder radish as on the rape, indicating a preference for the radish leaves.

Lamb finishing trials

On 21st September, 12 lambs from one farm and 8 from another were put on to 1-acre plots of each crop for finishing. The lambs were given approximately the same area of each crop at the beginning of the trial and were then allowed access to successive breaks whenever one of the two crops was eaten down to the extent that it was about to limit the progress of the lambs. At that time the front fences of both crops were moved forward to provide similar areas of both crops. As the trial progressed it became obvious that the lambs from the second source were losing both weight and condition. They were withdrawn after 30 days and the significantly greater weight-loss of those on fodder radish compared with those on rape can be seen in Table 3 (Group 2). These lambs had been dosed for worms before the trial began and appeared otherwise healthy. The exact cause of their lack of progress was not established.

By contrast, the lambs in group 1 (12 per treatment) did improve during the trial. The non-significant difference in favour of the radish-fed lambs shown in Table 3 would be much less if the result of one lamb in the rape-fed group was ignored. It lost a total of 8 lb during the period. Nevertheless, although similar weight gains were made, the grading results are very much in favour of rape as a fattening crop, since 11 out of the 12 were fit to grade off it (9 graded A) but only 8 of the radish-fed 12 were ready (6 graded A). This

TABLE 3

Blackface wether lambs—liveweight data

	1964				1965		
	Group 1		Group 2		Rape	Fodder radish	Direct reseed
	Rape	Fodder radish	Rape	Fodder radish			
No. of lambs	12	12	8	8	12	12	12
Av. no. of days on trial	42	42	30(a)	30(a)	55	61	60
<i>Weight changes (lb)</i>							
Av. weight on	59.2	59.0	66.6	69.0	55.9	56.9	56.2
Av. weight off	62.2	63.7	62.4	58.8	67.1	62.0	68.5
Av. total liveweight increase	3.0	4.7	-4.2	-10.2	11.2	5.1	12.3
Av. weekly liveweight increase	0.5	0.8	-1.0	-2.4	1.5	0.6	1.5
Standard error of the difference between two means	±0.29		±0.50		±0.18		

(a) withdrawn after 30 days

finding is supported by the killing-out percentages of the graded lambs, which were 45.5 per cent from those on rape and 43.1 per cent from those on fodder radish.

In 1965 a similar procedure was followed with 12 lambs, all from the same source, allocated to each of three crops. The first two were one-acre plots of rape and fodder radish sown on 18th July and the third was an adjoining timothy/meadow fescue direct reseed of about $1\frac{1}{2}$ acres. Progressive breaks of each crop were offered in the same manner as in 1964. From Table 3 it will be seen that the lambs made better progress in 1965 than in 1964 (9.5 lb compared with 3.9 lb), but they took 16 days longer to do so. Treatment for foot rot was required for a small number of lambs on each treatment. In 1965 the fodder radish gave significantly poorer average gains than the rape to the extent of 6.1 lb in 6 more days. The lambs were on trial for an average of 58 days. A first draw of lambs was sent off 7 weeks from the beginning of the trial, and a final draw after 9 weeks when the trial was concluded. The lambs on the direct reseed made gains similar to those of the lambs on rape although given a greater area per head and taking an average of 5 days longer.

The grading results for the second year's trial gave further confirmation of the inferiority of fodder radish for finishing lambs. Whereas 11 lambs graded A and 1 was not fit to grade from the groups fed on rape and from those on the direct reseed, the fodder radish produced only 3 Grade A lambs and 1 Grade B, while the remaining 8 were judged not fit to grade. Once again killing-out percentage confirmed this result. It averaged 42.2 per cent from the fodder-radish lambs, and 43.9 per cent and 43.4 per cent from the rape and reseed respectively. In neither year was the fodder radish in flower when the lambs were put on to the crop but it was in full flower by the time the lambs had reached the half-way mark.

Conclusion

The conclusion to be drawn from these experiments is that a fodder radish crop which comes into flower while being fed off is not a suitable general

alternative to rape for fattening store lambs under west of Scotland conditions. There may, however, be a place for fodder radish on farms where clubroot disease is a serious problem, or where the growing period is likely to be too short for rape, provided the crop can be given suitable management.

Acknowledgments

We wish to thank the co-operating farmers and county advisory officers for their assistance in establishing and harvesting these trials, and for their observations and comments. Seed for the 1964 trials was gifted by the Edinburgh School of Agriculture. Dry matter and nitrogen determinations were carried out by the Chemistry Department of the West of Scotland Agricultural College.

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Colorado Beetle in 1965

THIS was the thirteenth successive year in which no breeding colony of Colorado beetle was reported in England and Wales, but twelve live and nine dead beetles were found on ships and in association with imported vegetable produce, timber and old sacks.

Only three of the live beetles were clearly associated with imported vegetables; one was found on Portuguese timber and eight on ships sailing from continental ports. Three of the dead beetles appeared to have died very recently and of the remainder, two were found in frozen and one in canned Italian spinach and two in canned Yugoslavian blackberries. Dead beetles are not, of course, of any danger to this country, but they do help in indicating the distribution of Colorado beetle in other countries.

The main source of information about spread of the beetle in Europe is the annual report of the European and Mediterranean Plant Protection Organization. The latest one, for 1964, shows that in Austria, communes in Styria, Carinthia and Salzburg suffered their first attacks at sub-alpine to alpine altitudes; in Salzburg, infestations were believed to be the result of airborne invasions. In Switzerland damage was reported in areas up to 1,200 metres (3,600 feet approximately) above sea level, which may be the upper limits of the pest's distribution. In Yugoslavia, there was a spread to several new areas and in Turkey there was a further advance in Thrace to the two provinces Kirklareli and Tekirdag.

The Ministry is grateful to everyone who reported the presence of Colorado beetles and hopes for the continued help and vigilance of the public in the campaign against this pest.

H. W. JANSON

Cubicles for Bullocks

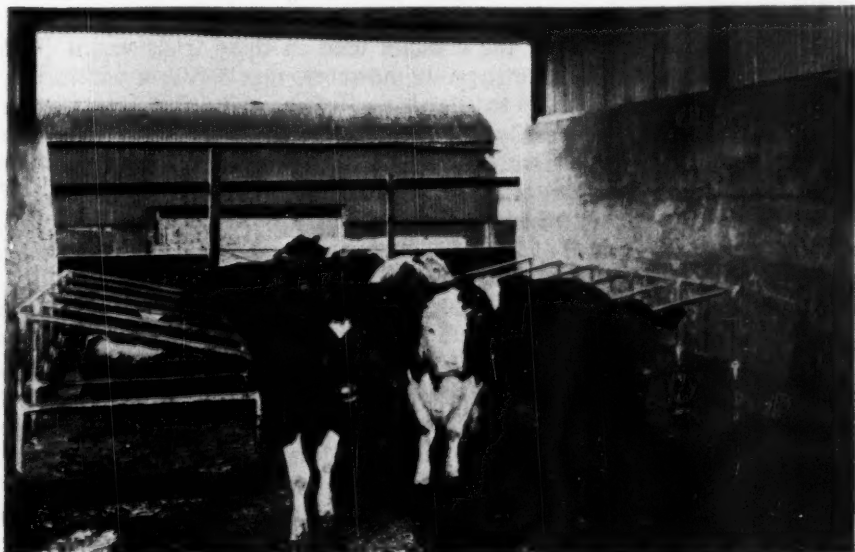
A summary of evidence from Northern Ireland
on the possibilities of this system

by Nigel Harvey

MANY farmers nowadays are considering the advantages and disadvantages of the various ways of housing beef cattle. Perhaps the experience of their milk-producing brethren can help them in their decisions, for recent trials at research centres in Northern Ireland suggest that the cubicle system, which has so strikingly proved its value for dairy cows, can be successfully adapted for bullocks.

In principle, the system is the same as that used for housing dairy cows—one or two rows of cubicles with a passage behind or between them leading to a feeding and exercising area. The purpose of the cubicle, too, is the same, the provision of a dry, quiet, comfortable bed. But the different needs of the two classes of animals create certain differences in planning and design.

Cubicles for bullocks. A temporary installation in a bunker silo



Adjustment for size

In particular, the dairy cow remains approximately the same size, whereas the beef animal grows. Farmers who are only concerned with finishing grown cattle may need only a once-and-for-all type of cubicle. But those who are concerned with growing cattle require some method of ensuring that cubicles keep pace with the increasing size of their inhabitants.

There is no standardized answer to this problem. Various enterprising farmers and research workers have developed systems of movable head sections and partitions of timber or metal attached by pins or by nuts and bolts to a framework along which they can be shifted as required. These ensure that, throughout its life, the animal has sufficient space for comfort but not sufficient room for turning around, and that its back-end is always over the curbstone of the cubicle.

Such equipment can be made on the farm and is not expensive to operate. In one case, one man can adjust the widths of twenty-five cubicles in an hour. But other investigators have not found such systems wholly satisfactory, particularly as metal parts tend to rust which makes adjustment difficult, and they prefer equal numbers of cubicles of different lengths and widths to which the cattle are moved as they grow.

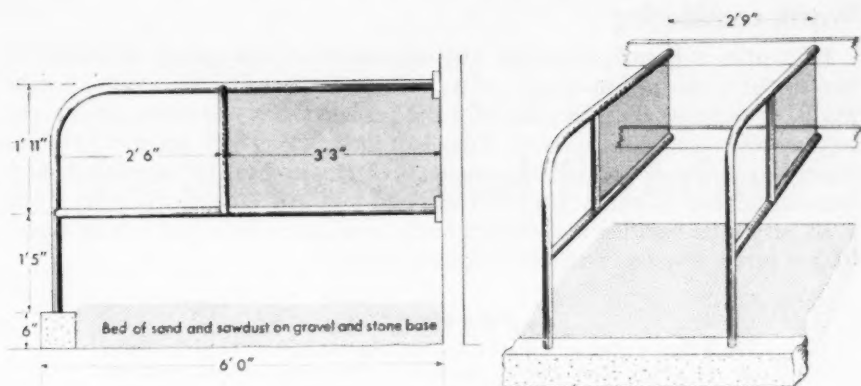
Drainage of the cubicle

Nature has equipped bullocks with plumbing arrangements very different from those of cows, and this suggests the need for cubicles considerably better drained than those in dairy installations. Rather surprisingly, however, experience shows that the problem is by no means as serious as it appears. One research worker found that most bullocks became 'cubicle-conscious' and backed out of the cubicle to pass dung or urine. Another reported that the 'wetting of bedding has not proved a difficulty and there has been no need to make elaborate arrangements for the disposal of urine'. Apparently, most of the liquid dries out naturally and little drainage is required.

Construction

The maximum lengths of the cubicles used in these trials varied from 5 ft 6 in. to 7 ft. Experience suggests, however, that 6 ft is a satisfactory length for grown cattle of up to 10 cwt live weight and 6 ft 3 in. for larger beasts. Stall lengths can easily be varied by means of breast-boards. For calves, a width of 1 ft 9 in. was recommended at 3 months, 2 ft at 7 months and 2 ft 6 in. at 9 months. For grown cattle of up to 10 cwt, a width of 2 ft 9 in. was adequate; for larger cattle, a width of 3 ft. Thus, in one trial, it was found that a width of 2 ft 9 in. did not allow Friesian steers sufficient space to turn their heads to lick themselves. So a further 3 in. was added.

The construction of cubicles is simple. A sleeper or a concrete curb separates the bed from the passage-way. A curb height of 6 to 9 in. is recommended; the smaller figure is probably better, since some animals are nervous of stepping backwards down a height greater than this. Curb widths of 1 ft have proved unsatisfactory, since cattle found little difficulty in standing on them and then backing into the cubicle. Widths between 4 and 8 in. are therefore preferred. As a precautionary measure, concrete curbs might well include drainage outlets to remove surplus liquid. Adjustable or fixed partitions, sometimes of tubular steel, sometimes of timber, separate the



Typical cubicle for bullock of up to 10 cwt

lying areas. The bottom rail of these partitions should stand at least 1 ft 3 in. above the level of the bed. If it stands any lower, it may cause bruising when the animal lies against it.

Bedding

Various materials are used for bedding. The simplest is a mixture of straw manure and silage debris. Cattle on this bedding were kept 'as clean as dairy cows' by a shovelful of sawdust once a week. Gravel-based beds of sand and sawdust raked once a day and topped up with sawdust as necessary work well. In greater detail, beds of a layer of 4 in. stones covered with 1½ in. of broken stone, ½ in. of screenings and finally 3 in. of sawdust have proved satisfactory in two seasons' trials.

So there is nothing particularly complicated or expensive about beef cubicles. How does the system work in practice?

The system in practice

The reports show that some cattle took a few days to accustom themselves to the new form of housing, but after that the system worked well. The animals lay clean and appeared comfortable. They were quieter than those in conventional yards and, of course, required considerably less bedding. Weight gains were similar to those in other systems of housing. In the one comparative trial quoted, steers housed in cubicles put on an average of 2·3 lb per day and steers housed in stalls put on 2·15 lb per day.

The feet of the bullocks housed in cubicles kept in good condition, in one case in better condition than those of bullocks in a straw yard, because they spent much of the time on the concrete of the passage-way and the exercising and feeding area. The importance of this was shown in one trial where for experimental purposes bullocks were confined for long periods to cubicles with sawdust bedding and in consequence suffered from overgrown hooves.

The manure was easy to handle. It was generally cleared by tractor-mounted blade on to a concrete apron and spread by normal distributors. In one case, cleaning the passage-way of a 50-cubicle house required 10 to 15 minutes daily.

Worth considering

Of course, it is early days yet, and experience of this system is limited to two or three seasons' operation of a few installations. But the evidence now available suggests that cubicles offer the beef-producer the same advantages as they offer the milk-producer. They suit the cattle, which are comfortable, clean and thrifty in them. They also suit the farmer, for they are simple and therefore cheap to build. They can be fitted into any suitable building. They need very little bedding and consequently economize litter and labour costs. This is surely a system well worth consideration.

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The Ministry's Publications

Since the list published in the April, 1966, issue of *Agriculture* (p. 169) the following publications have been issued.

ADVISORY LEAFLETS

(Price 4d. each—by post 7d.)

- No. 91. Mangel Flies (Revised)
- No. 179. Leatherjackets (Revised)
- No. 215. Gooseberries (Revised)
- No. 241. Leaf Spot of Celery (Revised)
- No. 421. Cereal Root Eelworm (Revised)
- No. 482. Ensiling Grass (Revised)
- No. 540. Lighting for Egg Production (Revised)

FREE ISSUES

- STL No. 51. Tomato Grafting Technique (New)
- STL No. 53. Black Currant Leaf Spot Control (New)

The priced publications listed above are obtainable from Government Bookshops (addresses on p. 242), or through any bookseller. Unpriced items are obtainable only from the Ministry (Publications), Tolcarne Drive, Pinner, Middlesex.

Part-time Cereal Farming

G. J. Clarke

PART-TIME farmers grow in England and Wales, according to the 1963 agricultural census, about 70,000 acres of roots, 15,000 acres of vegetables, 320,000 acres of cereals and 20,000 acres of orchards or soft fruit. Part-time farming therefore, in total, is big business. The number of part-time farmers occupying small acreages is, however, decreasing. Costs are rising and it is becoming more difficult for them to compete successfully with full-time farmers. Moreover, many are tempted to sell their land in view of increasing value and pressure from nearby full-time farmers.

There are some indications, however, that a new class of farmer may be emerging. At the time of the 1963 returns there were 144 part-time farmers in the 100-300 acreage group in the eastern region of England, and by June, 1964, the number had increased to 180. In this area it is probably safe to assume that most of those who are farming a substantial acreage part-time are doing so mainly by growing a large acreage of cereals. In fact, this trend towards larger units is developing more on the mineral soils than on the fens, as the following figures show:

<i>Acreage group</i>	<i>Numbers of part-time holdings</i>	
	<i>Cambridgeshire</i> (mainly mineral, some fen)	<i>Isle of Ely</i> (mainly fen, some mineral)
5-20	458	795
20-50	167	236
50-100	96	8
100-150	15	2

Influence of soil type

There is a sharp contrast between part-time farming on the mineral soils, as compared with the fen soils, in Cambridgeshire and the Isle of Ely. In the fens the part-time farmer is often working full time in agriculture but off his own holding in normal working hours. He regards his farming activities as a means of supplementing his income largely as a result of his own physical labour. Sometimes he is able to use his employer's machinery and equipment, and consequently his fixed costs are very low. He is able to work in his spare time on his own intensive crops of strawberries, sugar beet, potatoes, etc., and thereby obtains a remuneration which at the end

of the year is often better than he would have gained working for the same period of time as an employee. Nevertheless, he is faced with increasing costs and diminishing returns, and often with some discouragement from his employer. Moreover, potatoes have in the past been one of his main sources of income, but increasing potato root eelworm infestations have caused declining yields and lower profits. Consecutive cereals as an alternative crop on fen soils are far more uncertain than on the mineral soils. Moreover, because of the limited acreage they do not give an adequate return per holding. The following figures illustrate that part-time farming in the fens is confined to the smaller acreage groups:

Acreage group	Percentage of part-time farmers
15-20	47
20-25	44
25-30	15
30-35	12
35-40	12
40-45	6
45-50	Nil

On the mineral soils the approach to part-time farming is usually very different unless there is ready access to markets for intensive crops. Although it is impossible to generalize, the person who is often attracted is one who is well educated and who has capital for investment. Even if he has little or no farming ability he can usually employ a contractor to do all the work. Managerial requirements involved in farming with a high intensity of cereals are not so exacting as intensive arable or livestock enterprises. Moreover, consecutive cereals on mineral soils will usually give satisfactory returns on capital. In addition, there is the amenity value of week-end shooting, plus the satisfaction of living on a farm. The knowledge that land is a resource which is becoming increasingly scarce provides an added attraction.

Part-time farming with continuous cereals

There are two cases in the Cambridgeshire area that illustrate this latter approach to part-time cereal farming. In one case the farmer was a professional worker in a nearby town. He farmed approximately 130 acres of sandy loam soil. Practically all the farm was sown with cereals from 1954 to 1963, with the following results:

	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Variety	Earl Cappelle	Earl Cappelle	Earl Cappelle	Ingrid	Ingrid	Ingrid	Proctor	Proctor	Proctor	Proctor
Yield (cwt per acre)	30½	35	34½	23	17	38	29	26	24½	20

Almost all the work was done by contractors and only slight alterations were required to make a double-range cowshed suitable for storing grain. The above figures indicate that the average yield over the ten-year period was 27½ cwt per acre. Moreover, the average yield for the last five years was only marginally less than for the first five years. The reasons for the great variations between individual fields and also between seasons are not always apparent and these require detailed investigation. From the purely technical point of view, this type of farming is more exacting than that which is run along traditional lines.

The second case involves a farmer who also has about 130 acres. The soil is chalky boulder clay. Again, the farmer has a professional full-time job and all the farm work is done by a contractor. Practically no capital has been involved in grain storage as most of the crop is sold immediately after combining. This farmer was fortunate in being able to buy four years ago, at less than £100 per acre, land which is worth far more today. He bought the farm as he considered that the value of land in this country was absurdly low compared with that on the Continent and was bound to rise. The purchase of land was, therefore, an investment in itself, irrespective of what he was going to do with it. Rather than put his money into stocks and shares, he felt that he was on a safe and remunerative wicket in investing in land. Having purchased the land he decided that—

1. Physical work on the farm which could be valued at little more than £10 a week was insufficiently rewarding; in any case he had no training in farm work.
2. There was no justification in tying up capital in fixed equipment.
3. With little knowledge of farming, he would not wish to face the responsibility of directing farm staff.

He has therefore employed a contractor to do all the farm work. Only essential cultivations are done and the contractor's charges are about £10 per acre per annum. Seed, fertilizers, sprays, etc., cost a further £10 per acre. Little further cost has been involved. The farmhouse provided him with suitable accommodation, and as wheat has averaged 30 cwt per acre and barley 27–28 cwt, his profits have been substantial.

In both cases mentioned the farmers have leaned heavily on the N.A.A.S. for advice: clearly, early signs of a breakdown in the system must be observed and corrected. Bare fallowing may occasionally be necessary. The field bean crop is now to some extent regarded as a cleaning crop, especially as it can be sprayed against wild oats and blackgrass, and it may help to reduce the risks of continuous cereals. Combine harvested beans lend themselves almost as well as cereals to contract work. On the other hand the crop may in some seasons be very difficult to sell; nevertheless it could fill a need on these farms.

The average yields of cereals on both farms could drop to 24 cwt per acre and the farmer would still make £1,000 profit per year. Economists and farmers could well argue that this is not giving an adequate return bearing in mind the present value of these farms. This argument may not be very realistic, however, in view of continually increasing land values and provided, of course, that excessively high sums were not paid at the time of purchase. Both farmers, moreover, have been in a position to sell at any time without fear of heavy depreciation of fixed equipment and machinery; investment in both these items has been negligible.

Long-term prospects

The long-term success of such farming enterprises rests upon the ability of the land to grow continuous cereals which give satisfactory yields. This depends upon:

1. Adequate control of grass weeds, including wild oats.
2. Control of diseases and pests.
3. Maintenance of adequate drainage and satisfactory soil texture.

Work in Cambridgeshire suggests that yields of continuous barley over periods of up to ten years average just over 30 cwt per acre on heavy clay soils. On the sands and chalks average yields decrease, and after four to six years may drop to about 24–25 cwt per acre. The lighter soils, however, are much more suitable for root crops, and it is on the heavier soils that part-time farming with cereals is particularly attractive. In fact 85 per cent of all the land on farms between 100–150 acres on Cambridgeshire clays is under cereals. It is on these soils that any deterioration in drainage should be carefully observed and rectified. This is the type of observation that a farmer skilled in husbandry and working on the farm full time is most likely to make before yields are seriously influenced.

Poor drainage not only encourages weeds, but areas of disease often develop where drainage deteriorates. The part-time farmer is obliged to make haste in all his work. He cannot easily decide to set aside land for special cleaning operations. There is therefore considerable risk that over a period the condition of the whole farm may deteriorate. However, even if a complete tile drainage system has to be installed in this drier part of the country, the total cost will probably be no more than £50 per acre. After taking the drainage grant into account, and writing off the investment over many years, the amount per acre is only small per annum.

Economic implications

The farmer who is faced with farming full time 100 acres of mineral soil would probably have the prospect of making a net farm income of £10–£12 or so per acre from cereals. He would not be fully occupied nor would he receive a sufficient livelihood from the return on cereals alone. To increase his income he might adopt one of several policies. On the one hand he might grow sugar beet or potatoes if the soil was suitable; by so doing he might raise his net farm income to £20 per acre and obtain a total income of £2,000 for his 100 acres. Alternatively, he might cultivate his land with the aid of a contractor (if a good one is available) drilling mainly cereals, and spend practically all his own time on an intensive livestock enterprise on the farm. His total income would then depend upon the size of the intensive livestock unit and his skill in livestock husbandry.

In either case the farmer will have invested a large capital sum in fixed equipment. Furthermore, he will have to use a great deal of hard physical labour and managerial ability. Many men may find great satisfaction in complete absorption in farming, but some, especially those who can command a good professional salary, may well be attracted to part-time farming and feel safe in the knowledge of increasing land values and of a reasonably secure cereal market. They would also feel reassured, if failure threatened, at the ease with which the enterprise could be sold and would usually expect to make a substantial capital gain. From the economic point of view there is a great deal to be said in favour of the arguments put forward by the part-time cereal farmer. In practice, over a period of time land may well become increasingly foul and drainage may deteriorate. One has to weigh up the relative importance of these various factors in assessing the worthwhileness of this type of farming, and it is still probably too early to give a verdict.

This article has been contributed by **Gordon J. Clarke, N.D.A.**, who is N.A.A.S. County Agricultural Adviser for Cambridgeshire and the Isle of Ely.

Heathland Reclamation

in East Suffolk

(2)

G. R. Field

Drought

By 1958 a number of heathland pioneers were aware of all the mineral deficiencies, and in that year of abundant summer rainfall, yields of 26–28 cwt per acre of barley were obtained. In contrast, 1959 produced the classic hot, dry summer and, despite timely cultivations and provision of the necessary nutrients, barley crops in June were severely stunted with small ears on a straw no taller than 9 in. Lack of rain was an obvious cause of this condition, but was it the only cause?

In many heathland crops small areas showed up dramatically where the barley had made very good growth with straw 30 in. long supporting normal-sized ears. Close examination of the root systems showed that over much of the heath an iron humus pan had prevented rootlets penetrating the subsoil below 18 in. Because of the very light nature of the soil, the maximum soil moisture reserve available to the crops at field capacity was probably no more than 1 in. and this was only sufficient for 10–12 days normal growth in late May or June. In the small areas of good growth no pan was found, and the roots could be traced 4–6 ft into the subsoil in their search for moisture. These plants had access to a soil moisture supply totalling 3–4 in., sufficient to promote normal growth during a prolonged drought. Many of these drought-resistant patches corresponded with Army trench sites which had been refilled during the reclamation.

Thus it appeared that lack of root depth was just as important as lack of rain. The N.A.A.S. confirmed these observations in the following year on Martlesham Heath using small scale plots. On some plots the iron humus pan at 15 in. was thoroughly shattered in the course of breaking the subsoil to a depth of 30 in. The site was drilled with barley in March and trace elements were subsequently given to all plots. May and June were dry months, and by early July those plots which had received trace elements only were severely suffering from drought conditions. On the other hand, the barley on the deep cultivated plots exhibited normal growth having had access to twice the soil moisture reserves of the plots that had received minerals only. The effect of the addition of lime to the acid subsoil (from 15–30 in.) was to increase



*Tandem tractor with
subsoiler attached*

slightly the leaf area, and also to intensify the manganese deficiency symptoms during the early stages of growth.

The implications of these studies raised many practical questions. To what depth should the subsoil be shattered? Which was the best implement for the work? How far apart should the bursting tines be set? How much power would be required? How much would it cost? Complete satisfaction on these points would require an expensive long-term investigation.

Nevertheless, the effects of subsoil conditions on drought resistance were so spectacular in 1959 that one pioneer immediately invested £2,500 in a powerful tandem tractor and a heavy double tine cultivator. Nearly 400 acres of heathland were subsoiled to a depth of 26 in. with the tines similar to those of a mole plough passing at intervals of 30 in. The response of the 1960 barley crops was interesting; in late June the treated fields had assumed a corrugated appearance. The barley growing immediately above the path of the subsoil tine showed good drought resistance for a width of 8 or 9 in., whereas between the tine marks there was no improvement. Further confirmation had been given on the value of bursting the subsoil, but obviously the tines were required to pass closer together. Subsequent experience indicated that a second passing either at right angles or diagonally across the first should give satisfactory results.

Irrigation

From the foregoing it can be seen that heathland in such a low rainfall area is likely to respond particularly well to irrigation. It is not uncommon for irrigation to be used on cereals during May before it is required for root crops. With the help of irrigation, 18 tons per acre of sugar beet and 14 tons per acre of King Edward potatoes have been consistently grown. These heath soils are well suited to irrigation; crops respond well and surface capping caused by the beating action of large droplets on bare soil rarely occurs.

Economics of heath farming

It seems therefore that with correction of mineral deficiencies, the breaking of subsoil pan and/or the use of irrigation, acid heathland can be made very productive. But is the whole process economic?

The general local opinion of the agricultural value of this land was such that it could be readily purchased for between £15 and £30 per acre in the early fifties. The original reclamation work cost just over £20 per acre up to the point of drilling the first crop. Nearly half of this cost was recoverable under the ploughing grant scheme. The annual supply of copper and manganese can be provided for less than £1 per acre. The benefits of subsoiling appear to last for at least 5 years and this work is costed tentatively (based on the power requirement and spacing of the tines) at £10 per acre. Thus for cereal crops the gross margin would be calculated as follows:

Variable costs per annum

	£	s.	d.	
One-tenth reclamation cost (less ploughing grant)	1	1	0	
Copper, manganese + wetters		18	0	
One-fifth subsoiling cost	2	0	0	
Seed	2	10	0	
Fertilizer (60N, 36P, 54K)	4	0	0	
Herbicide		10	0	
	<hr/>			
Total	10	19	0	per acre
	<hr/>			
Average gross return				
22 cwt barley at 20s. per cwt + C.D.P.	=	27	10	0 per acre
	<hr/>			
GROSS MARGIN	=	16	11	0 " "

Bearing in mind that in all cases the heath is farmed in association with large arable farms, the low gross margin on cereals is quite satisfactory in view of the small increase in fixed costs incurred in the cultivation of this easily worked land. Ploughing and drilling often take place in the winter months when the remainder of the farm is unfit for cultivation. Similarly, harvest is ready a week or so earlier in the season.

Successful root crops demand irrigation on the heaths as well as careful attention to trace element needs. Irrigation costs vary according to the water source available and an example of a more expensive installation would be:

Barley showing corrugated pattern of growth after subsoiling at 2ft 6in. intervals



	£	s.	d.
Cost of borehole and pump (to supply 11,000 gal per hr)	2,200	0	0
Electrical works	200	0	0
Permanent main ($\frac{3}{4}$ mile)	2,000	0	0
	4,400	0	0
Less 40% grant	1,760	0	0
Net cost	2,640	0	0
Portable main ($\frac{1}{2}$ mile)	1,160	0	0
Sprinklers (1 $\frac{1}{2}$ acres per setting)	400	0	0
Total capital cost	4,200	0	0

Based on a seven-year life and charging 7 per cent interest on capital, the annual cost of using the equipment would be:

	£
Depreciation and interest on capital	747
Repairs and maintenance	100
Cost of fuel and labour	200
Total annual cost	1,047

The annual benefit from 30 acres of sugar beet and 30 acres of maincrop potatoes would be:

	£	£
Extra washed beet—5 tons per acre at £6 12s. per ton	990	
Less 12s. per ton haulage	90	
		900
Extra ware potatoes—5 tons per acre at £14 per ton	2,100	
Less £1 per ton picking cost	150	
		1,950
Total annual benefit		£2,850

This handsome return on irrigation coupled with the ease of seedbed preparation, low-cost chemical weed control and soil conditions ideal for root harvesters makes root growing an attractive proposition on the heaths.

Since 1949, nearly 3,000 acres of natural heathland have been brought into cultivation in the Woodbridge area. Each year sees further reclamation work in hand. This is encouraged partly by rising land prices and the rising productivity of the mechanized arable worker, but is mainly the result of the farmer's confidence in his ability to husband the land successfully. Indeed, by the full employment of scientific knowledge and modern techniques, these naturally infertile heaths are now making sizeable contributions to farm incomes in the Woodbridge district.

The author wishes to acknowledge the generous assistance given by N.A.A.S. soil chemists, Dr. N. H. Pizer and T. Caldwell, and by farmers in the Woodbridge district.

(The author's first article on this subject appeared in last month's issue)

40. East Shropshire

W. J. A. Thurgood

THE Wrekin district embraces most of the light land arable area of east Shropshire. It is a diamond-shaped area extending from near Market Drayton in the north down through Newport, Wellington and Shifnal to within a few miles of Bridgnorth in the south. It is bounded by Staffordshire on the east, the River Severn on the south-west and the River Tern on the north-east, and forms the southern extremity, at an elevation of 200–250 feet, of the north Shropshire–Cheshire plain. The Bunter sands and pebble beds are largely overlain by the light glacial deposits of the Northern Drift—the Newport series of soils. The exception to this is the large up-thrust of Upper Coal measures and older and igneous rocks, south of Wellington, which form the Dawley plateau, with the Wrekin (1,335 ft) at the north-west corner. This plateau was the scene of some of the earliest industrialization and is riddled with small shallow coal and ironstone mines and innumerable spoil tips. There are still two deep mines but the shallow mines have been replaced by opencast working, now essentially for valuable clay deposits. The first iron bridge in the world still spans the Severn as a reminder of the early ironworks in the area. All this land, of low agricultural value, is now within the designated area of Dawley New Town.

The rainfall in east Shropshire is about 25 inches a year, much less than the rest of the county and adjoining areas, apparently because a ‘rain-shadow’ fans out eastwards from the Wrekin. This low rainfall, combined with the light, easily-worked soils, has produced a first-class arable tradition. To the proud Salopian this is the finest farming area in all the world. Certainly it deserves its wider reputation as one of the best areas in the country. Level sandy loams, with medium-sized fields in farms of 250 to 500 acres or more, have produced a high standard of mixed farming.

This was the Ryeland, an area of acid sandy heaths. (The Wheatland is the heavier land across the Severn). The coming of the lime cart was the first stage in its development and the building of the Allscott sugar beet factory, near Wellington, enabled a profitable cash crop to be brought into the rotation. A few pioneering farmers, the great influence, by example and education, of Harper Adams Agricultural College, Newport, and the area was transformed.

Rotations are very important in the district. Not inflexible, as at one time, but firmly maintained. Barley barons and single enterprises are not known here. Four-crop enterprises are usual—wheat, barley, potatoes and sugar beet—with two or more stock enterprises—beef or dairy, sheep, pigs or poultry. A ley, usually of two years, sometimes more, is followed by potatoes. The ley means beef, traditionally, or dairy, and sheep. The potatoes benefit from the moisture-retaining humus of the ley and are followed by winter wheat and sugar beet (sometimes the other way round) and then one or more crops of barley before undersowing. Potato lifting starts in late June, after Pembroke, and continues through the second earlies. Most crops are sold by January. Yields of 12–15 tons per acre are usual but recently irrigation has increased rapidly and 20 tons of second earlies and main crop are now common. Sugar beet can vary from 11 or 12 tons on the pebble beds to 16 or 17 tons on the better land, but again irrigation is levelling-out the dry years and 20 tons and over are now obtained frequently. Potatoes are still the labour-consuming crop, with largely traditional cultivations, but sugar beet is fast becoming 'untouched by hand' like the cereals. Winter wheat is preferred and gives two tons per acre or more, while spring barley, although often topping the two tons, averages about 38 cwt.

Beef is essentially a winter yarding enterprise, for the muck, although there is considerable summer grazing and fattening. Many farms do their own rearing but mostly it is stores from the south of the county and plenty of Irish. The white-faced is still favourite and feeding is traditional, with arable by-products, even if barley does form a large part of the ration. Sheep are mainly Cluns, crossed with Down rams. Much of their winter is spent on the beet tops and kale, rape and turnips after the early potatoes. Pigs are now nearly all white; the Old Spot has all but disappeared. Although most farms keep some pigs, units are getting larger and often becoming either breeders or feeders, with the larger fellows doing the whole job. Poultry are not numerous and are mainly in large units. Dairy cows, like hens, are not the favourites of the arable men but dairy herds are well scattered over the district, are growing larger, and are the most profitable users of the essential ley.

There is a uniform type of farming throughout the district, yet there is scarcely a field that is uniform of soil type (although all of the Newport series) across its length and breadth. Nor is the standard of farming uniform, for while most of it is good, much is very good. Those who refer to mixed farming as muddled thinking would do well to look hard at this area. Despite the ups and downs of individual enterprises, the range and interweave of the several crops and stock on the mixed farm ensure a more even profitability over the years. Mixed farming needs more labour. The good profits and adequate labour in east Shropshire enable farms to be maintained in first-class order. Drains and hedges are well cared for; buildings and roads are in good repair. There is adequate equipment to handle and store the arable products and various livestock. There is almost, but never, too much machinery. Plenty of good equipment makes it possible to work the land only when conditions are right and it is wonderful to see how quickly the work is done. Best of all is the farmers' ability to manage their complex holdings so well. East Shropshire is a fortunate combination of good men on able land in the right climate.

J. C. Glover

*Agricultural Land Service,
Aberystwyth*

Building on an Exposed Site

BEFORE building on an exposed site it is essential that careful consideration be given to certain aspects of construction and design—detail which on a more sheltered site would not be so important.

For instance, when siting a new building use should be made of the natural contours to obtain as much shelter as possible from the prevailing winds. Again, building near to tall trees may not always provide the shelter expected because their very presence can cause turbulent conditions and possible damage to nearby roofs. Siting the new building, then, is a matter of primary importance.

The most common materials used today for walling agricultural buildings are concrete blocks and brickwork, and the quality of both can vary considerably. There is a limit to the amount of rain that a solid wall can keep out, and in the wetter parts of the country and in exposed positions, 9 in. solid walls may show signs of penetration. Cavity walls, however, when properly constructed, do not normally permit penetration of rain. Walls made of hollow blocks might be regarded as halfway between solid and cavity construction, and provided the mortar bed does not extend from the outer to the inner face, they have a fair resistance to rain penetration. But a wall of this type in an exposed position can never be as resistant to penetration as a soundly-constructed cavity wall.

To prevent them absorbing rain, solid walls subject to exposure should be protected by cement rendering, rough-cast or pebble-dash. Great care must be taken to keep the mortar fairly weak and porous and the texture 'open' and rough so that if any water does penetrate into the wall, it can dry out. The best way of keeping an open texture to the face of the rendering is to have it 'spatter-dashed', i.e., thrown on to the wall by hand machine (not trowelled). An alternative which gives a rough texture finish, is to pebble-dash the surface, by throwing trowelfuls of dry pebbles against the rendered wall before the mortar sets.

Traditional, and more costly methods of protecting walls against driving rain are vertical tiles, slates or shingles, asbestos-cement sheeting, weatherboarding, plastic panels, etc. These encourage water to run down the face of the building quickly, but allow air to circulate between the cladding and the wall—an important consideration, particularly where there is no damp-proof course. In extreme cases of exposure, one of these cladding methods may be the only solution to driving wind and rain.

When natural ventilation is important, as in the case of a stock building, side and gable-end cladding in the form of 'Yorkshire' or open boarding can be used up to roof height above the walling. This cladding, comprising 4 in. \times 1 in. boards fixed vertically and spaced $\frac{3}{4}$ in. apart, is most effective, giving good ventilated conditions free of draughts within the building and complete comfort for the animals. There is hardly any penetration by snow and rain.

Wind braces should always be used in the roof construction of the end bays of framed buildings in exposed situations, along with other precautions such as the tying down of purlins with strap-iron, especially at the gable-ends. Corrugated sheeting may be laid down from left to right or vice versa. The open side lap should never face the prevailing wind, and extra fixing is recommended by means of additional drive screws or hook bolts.

In the case of tiling, all tiles should be nailed to the battens instead of to every third or fifth course, which is a method suitable only in normal conditions. Similarly, slates must all be nailed to their battens and can either be 'head' or 'centre' nailed. The latter is preferable as it gives better protection against strong winds—there is less lifting and less leverage on the fastening. Head-nailed slates can be lifted by strong winds, which allows rain and snow to drive up underneath and also enlarges the nail holes so that, in time, slates become dislodged. To prevent rusting, nailing with copper or composition nails is recommended. Roofing felt should be used under both tiles and slates as this provides a waterproof and draughtproof membrane which also makes the building slightly warmer.

Overhang at the roof verges should be reduced to little or none at all, as another precaution against the lifting of the roofing material by strong winds. This can also be overcome by the use of purpose-made asbestos-cement bargeboards which are fixed to the wall face and overlap the roofing material.

In exposed positions a slight increase should always be allowed in the pitch of the roof, i.e., the amount of slope given to the sides of the roof, and also in the lap given to the roof covering material. For example, when corrugated asbestos-cement sheeting is used on exposed sites, the British Standard Code of Practice and the manufacturers recommend a 25° minimum pitch and an end lap of 6 inches. For pitches below this, additional precautions are recommended, e.g., a 17½° pitch must have 6 in. end laps sealed, 15° requires 6 in. end lap with all end and side laps sealed, while a pitch as low as 10° must have 12 in. end lap and all laps sealed plus extra fixings at end laps.

Where required for ventilation, windows should be of the agricultural hopper type, opening inwards with cheeks on either side of the opening light, forming a hopper shape to force the incoming air upwards and not downwards on to stock within the building.

If practicable, all doorways, etc., should be confined to the leeward side of the building and a sliding door should be used in preference to a side-hung door; if left unlatched this can be badly damaged by the wind. It is important that sliding doors are properly hung and not allowed to swing on their tracks, being properly framed and with sufficient overhang to exclude draught.

Finally, foresight and care are required in initial decisions because these are paying business propositions for every type of building project—more especially when the building has to withstand the rigours and tests encountered on an exposed building site.

Books

Sheep Farming (7th Edition). ALLAN FRASER. Crosby Lockwood, 1965. 18s.

Written by a trained researcher with the enthusiasm and practical experience of a Scottish shepherd, this book is particularly welcome today when so many 'expert' treatises on sheep production are available. Allan Fraser can, at times, create havoc and confusion in many quarters by his choice of words. But in this, his first love, he writes as one with a rather special philosophical approach towards sheep farming which is so sadly lacking in the present generation of farmers and shepherds. He has strong views on many topics, but these are supported by his own experience in the field.

He makes a brief reference to the development of new breeds and crosses in this country and concludes that 'it will be some time before these hybrids reach the stage of commercial sheep farming'. Perhaps this is Fraser's method of answering the ever-increasing press propaganda by the big business operators, on the limitations of our present types and the superiority of their new crosses!

Supplementary feeding of hill ewes is looked upon with disfavour, but a hill farmer would hardly be impressed by the argument that 'expenditure on feed would be much better repaid by giving it to arable sheep than by pampering a hill flock'. While there are many circumstances where it would be unprofitable to feed hill ewes, the poor lamb crops on many hills would surely justify improved husbandry—though I must agree that the problem can only be resolved on the farm itself.

Present-day sheep farmers are apt to panic and reach for their syringes and drenchers at the sight of an unthrifty sheep without realizing, as Fraser so aptly points out, that starvation can only be cured by more or better feed. The section on lambing could only have been

written by one who has lambed ewes at all hours under extreme weather conditions, and his arguments for higher standards of husbandry at this critical period are especially relevant today.

A theme which runs continuously throughout the book is the necessity to adapt sheep to the land. One would have welcomed the author's comments on the suggestion that larger and more prolific types of sheep, housed in winter, could replace hill breeds in their native haunts; and also on the place of the small draft hill ewes on intensive lowland farms.

Fraser's view on the buying and selling of sheep could be read to advantage by everyone, and especially by newcomers to the industry.

Sheep farmers are by nature pessimists on the subject of intensification, so that the following ray of optimism is well worth quoting. 'These dangers (of intensification) *must* and *can* be faced, even although the hypodermic syringe rather than the crook becomes the symbol of our future sheep husbandry'.

The book is well produced and illustrated with excellent photographs. It is a 'must' for every young farmer, student, budding journalist and anyone concerned with sheep.

G.L.W.

Advances in Pest Control Research. Volume 6. Edited by P. L. METCALF. John Wiley and Sons, 1965. 84s.

This series of reviews '... offers a medium for publication of reviews and critical evaluations in all the branches of this complex field of applied science'. This is the publishers' claim and to judge from the range of the articles written so far and the fact that the word 'pest' is given its widest possible meaning, it is a fair claim.

Four of the six reviews deal with economic entomology, one with herbicides and one with plant chemotherapy. P. C. Kearnley, C. I. Harris, D. D. Kaufmann and T. J. Sheets review the *Behaviour and fate of chlorinated aliphatic acids in soils*, in particular, the widely-used herbicides dalapon and trichloroacetic acid. *Penetration and translocation of Rogor applied to plants*, by P. de Pietri-Tonelli, is a comprehensive account of the organophosphorus insecticide dimethoate, but like the first review, *Correlation between biological activity and molecular structure of the cyclodiene insecticides*, by S. B.

Soloway, treats a large group of chemicals containing such well-known insecticides as aldrin and dieldrin.

In *Natural models for plant chemotherapy*, A. E. Dimond's aim is to explore the natural processes whereby plants resist pathogens with a view to the potential contribution of such fundamental knowledge to plant chemotherapy. He draws a parallel with the development of medical chemotherapy, and clearly this subject offers opportunities for exciting progress in plant pathology. *Genetic studies on insecticide resistance*, by G. P. Georgiou, draws together knowledge on a subject that has aroused much interest in recent years and which is clearly of considerable practical importance. In the final article, *Nicotinoids as insecticides*, Izuru Yamamoto discusses the chemistry and insecticidal activity of naturally occurring and synthetic substances related to nicotine. Four of the reviews are drawn from the U.S.A., one from Italy and one from Japan.

This series of reviews gives good service to the specialist by enabling him to keep in general touch with fields of work wider than his own and quickly to locate information. All six articles in this volume are fully documented and the book as a whole is well indexed and produced.

F.H.J.

Digging for Britain. LORD WILLIAMS OF BARNBURGH. Hutchinson, 1965. 35s.

This is a modest little book by an essentially modest man. It will probably attract a limited readership for these very reasons. Those who find it dull and prosaic will be those who regard all Yorkshiremen as plain and a little dull. It fails as an autobiography for the reason that most autobiographies fail; the author, if his theme is worth while and unless he be a Churchill, always fails to do justice to his own talents and contribution to the times about which he writes.

But to those who knew the man and his contribution to British agriculture, particularly in the decade from 1940 onwards, the book evokes recollections of epoch-making action and of a simple, kindly and inherently honest man. One does not need the excellent photograph of the author to remind one of the clean-cut aquiline features, the well-groomed, curling hair and the wing collar and bow tie maintained through thick and thin throughout the war years.

The description of the early days in the pits has all been done many times before, sometimes better, sometimes worse, but never with more sincerity and less bitterness. One senses from the descriptions of the early days in Parliament, with the author's increasing interest in agriculture, the urge for power and the desire to make an impact on the farming scene. This part of the book is uninspiring largely for the very reason that the times themselves were uninspiring. But it is with the first junior Ministerial appointment in 1940 that the curtain really goes up; all that has gone before is mere prologue. The modest beginnings in the Ministry of Agriculture and the increasing dependence of the war-time Minister, Robert Hudson, on his politically opposed lieutenant, are all there in factual and unemotional phrases. In lighter vein the extraordinary, but highly successful, war-time partnership between the Hereditary Earl Marshal and the former miner as Joint Parliamentary Secretaries is brought out with flashes of dry humour and affection; at such points the book comes alive. For the most part, however, it is a plain, honest record about events which were far from plain.

The part of the book which deals with the author's period as Minister of Agriculture from 1945 to 1951 and which contains the description of the planning and execution of the new policy contained in the Agriculture Act 1947 is unexciting, and the author disappointingly fails to do himself or his subject justice.

The description of his party's defeat in 1951 and his subsequent elevation to the Upper House is poignant. One senses the virtual, but unadmitted, capitulation to the increasing pain and handicap suffered as a result of acute arthritis. But the honesty, old-world courtesy and kindness are still there as, too, is the dry but never bitter Yorkshire wit.

R.A.H.

Farm Buildings. Vol. I. Techniques, Design, Profit. JOHN B. WELLER. Crosby Lockwood, 1965. 55s.

Passing judgment on a half-finished work is almost a presumption, especially when, as in this case, it might appear that all the questions left unanswered in Volume I could be more than fully dealt with in Volume II if the schedule of contents is anything to go by.

At this half-way stage, however, one may be pardoned for wondering whether this work is designed to aid the designer of farm buildings or their user. There is so much in it which has to do with farming and by comparison so much less on the subject of building. One fears that the building specialist might give up in despair long before he emerged from the agricultural undergrowth, whilst, on the other hand, the enthusiastic layman might find too few answers to the practical problems which arise when designing buildings.

Mr. Weller is to be congratulated on his industry and perseverance, both in unearthing and setting down such an imposing amount of information. It is, perhaps, unfortunate that he has introduced a number of topics which though of current interest, may 'date' the work in a year or so.

The format of the book is restless and crowded, with everything packed in; rather like a Christmas stocking. The author has perhaps anticipated subsequent editions by the lavish introduction of costs. Even though, in many instances, the price ranges are comfortably wide, one suspects they may be out of date before very long. One might question the usefulness of a statement that a dairy layout can cost anything from £30 to £200 per cow. An estimate is only useful in so far as it relates to a precise set of conditions. Farm building problems tend to be individual rather than general, despite the lip service so often paid to 'standardization', so that 'from—to' estimates can be positively dangerous to the man who wants to know what he is going to spend.

Nevertheless, the book is a brave effort and an important contribution to the farm buildings library. Volume II will surely be awaited with considerable interest.

F.W.H.

Farm Amalgamation 1950-64. University of Nottingham, Department of Agricultural Economics. July, 1965. 5s.

Farm structure and what can be done to improve it has been a burning question for some time among many European countries. Yet little consideration had been given to what should and could be done about changes in farm size in this country until the Government's recent White Paper on the Development of Agriculture.

It is, therefore, interesting to see this report by the Agricultural Economics Department of the Nottingham University School of Agriculture on the results of a

small investigation into farm amalgamation carried out under the sponsorship of the Country Landowners' Association. It involved sending out a detailed questionnaire to a sample of estates, mainly large, all over England and Wales owned by selected members of the C.L.A. asking both about their policy for farm amalgamation and what has been happening in practice.

The report shows that, although many landowners have rather vague plans for increasing the size of their farms, in actual fact only a limited number of changes in farm size are taking place. The major alterations which occurred during the fifteen years covered by the investigation were due to sales of farms and increases in size of the home farm in the hands of the owner himself. The slowness of the changes is largely blamed on the difficulties arising from the security of tenure which the farm tenant now enjoys. This limits the owner's freedom of action until a tenant dies, retires, or, less frequently, moves elsewhere. Another important factor is the expense of remodelling the buildings on an enlarged farm, which is often considerable.

It is, of course, easy to find fault with an investigation like this because of the very few estates in the sample investigated and doubts as to how far the sample used is representative of landowning in general. But until more is discovered about the facts of landowning and current trends, anything which adds to the meagre total of knowledge is to be welcomed. The C.L.A. and Professor Britton and his colleagues at Sutton Bonington are to be congratulated on their initiative.

A.J.L.

Books Received

Grassland Research Institute. Technical Report No. 3. March, 1966. The appetite and liveweight gain of calves fed *ad libitum* on both grass and cold or warm milk. J. C. Tayler.

Chemical Control of Plant Nematodes. Technical Communication No. 36 of the Commonwealth Bureau of Helminthology. J. E. Peachey and Margaret R. Chapman. Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, 1966. 12s. 6d.

Goody's Nematode Parasites of Plants (3rd Edition). Technical Communication No. 30. Commonwealth Bureau of Helminthology. J. B. Goody, Mary T. Franklin and D. J. Hooper. Commonwealth Agricultural Bureaux, 1965. 60s.



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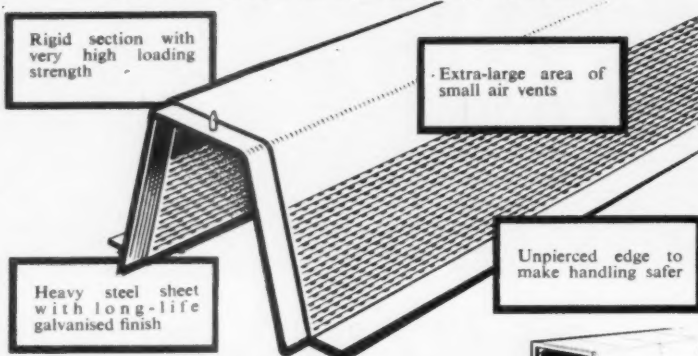
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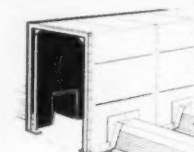
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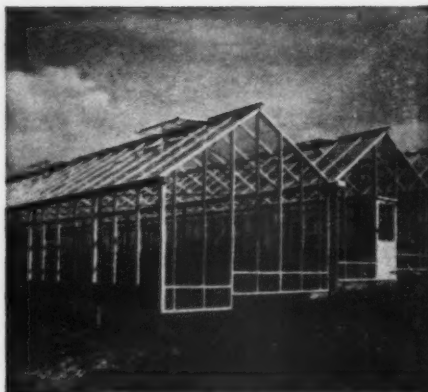
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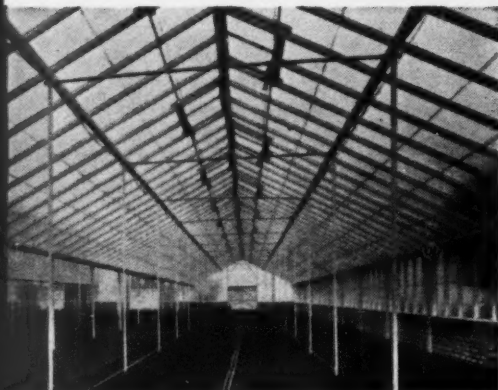
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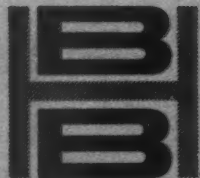
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